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# Primary Care Workforce and Continuous Medical Education in China: Lessons to learn from a Nationwide Representative Survey

**Short title:** Workforce and continuous medical education in primary care in China

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## **Abstract**

### ***Objectives***

This study aimed to examine the education and training background of Chinese community health centres' (CHC) staff, CME and factors affecting its participation.

### ***Methods***

A stratified random sample of CHCs based on geographical distribution and 2:1 urban-suburban ratio was selected covering three major regions of China. Two questionnaires, one for lead clinicians and another for frontline health professionals, were administered between September-December 2015, covering the demographics of clinic staff, staff training and CME activities.

### ***Results***

149 lead clinicians (response rate 79%) and, 1,734 doctors and 1,846 nurses completed the survey (response rate 86%). About half of the doctors had a bachelor degree or were registered as general practitioners (GPs) and 10% of them carried senior titles. Few nurses (5%) had training in primary care. About 90% of health professionals participated in CME. CME participation in doctors was more commonly reported by older, females, who registered as a GP or, with intermediate/senior job titles. CME participation in nurses was associated with holding a bachelor degree or, intermediate/senior job titles, or longer working experience in the CHC.

### ***Conclusion***

This representative survey confirms only half of doctors have bachelor degrees or are registered as GPs as their prime registration in the primary care workforce in China. The vast majority of CHC staff participated in CME but there is room for improvement in how CME is arranged.

**Key words** Continuous medical education, Training, Quality of care, Primary care, China

### Strengths and limitations

This study was the first study to survey the CME situation of a representative sample of medical staff in CHCs in mainland China. We focused on doctors and nurses working in CHCs, who are the core of the primary care workforce. Our study provides a useful baseline of the frequency and types of CME activities across a large number of CHCs. The main limitation of this study is that we focused on CME activities that were organised by CHCs but arguably those were the most commonly attended by the staff of individual CHCs. We did not evaluate the quality of CME being delivered or whether observable health improvements had resulted from CME participation. This could be the subject of future research through in-depth qualitative interviews of CHC staff and focused evaluations of CME programs in China.

### Introduction

The importance of a strong primary care system based on first contact access and provision of person-focused comprehensive care with continuity and coordination, is widely accepted.<sup>1-6</sup> Despite a strong primary care system being repeatedly shown to be an effective approach at reducing health inequity and achieving universal health coverage,<sup>2</sup> many countries have yet to develop a robust primary healthcare system. Instead, primary care services are often characterized by inadequate resources and facilities, lack of appropriate training for their medical staff, variable quality in delivery of care and fragmented care.<sup>7</sup> In China, these problems were further compounded by economic and healthcare reforms in the 1980s which involved fiscal decentralization, commercialization of medical services, and underfunding of the public healthcare sector. These turned a generation of health professionals and the general public to rely heavily on high-tech diagnostics, expensive drugs and specialist procedures.<sup>8,9</sup> These factors reinforced unrealistic patient expectations focused on specialist diagnostic aids and procedures, while alienating cost-efficient primary care

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3 that would better suit the nation's health needs.<sup>10</sup>  
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8 In 2009, the Chinese government responded to these problems and committed  
9 themselves to re-establishing primary healthcare.<sup>11</sup> According to Health & Family  
10 Planning Commission, expenditure on primary care has reached USD17.74 billion  
11 (1USD=¥6.20) and accounted for approximately 30% of the public spending on  
12 health in 2014.<sup>12</sup> In fewer than ten years, the Chinese Government has succeeded in  
13 establishing a primary care infrastructure composed mainly of rural township centres,  
14 village clinics and community health centres (CHCs) in cities. By 2014, 8,669 CHCs  
15 had been established, employing over 300,000 health professionals. However, the  
16 historical image of 'barefoot doctors' who had worked in rural regions since the  
17 1950s, criticism of the healthcare system by end-users, and negative publicity by the  
18 media have all led to a breakdown of trust between patients and health professionals,  
19 including in the newly-revamped primary care system.<sup>9</sup> This problem appears  
20 particularly pronounced in the cities where patients have greater choice and easier  
21 access to hospitals. One of the major problem is that CHC health professionals  
22 (doctors and nurses included) are regarded as poorly qualified and trained, and CHCs  
23 are poorly resourced, providing "low tech" facilities.<sup>13</sup>  
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42 In the past, medical courses were offered by a variety of colleges, vocational training  
43 schools and universities, ranging from 2-8 years of training. Graduates of these  
44 courses would have to sit and pass board examinations to be registered for their  
45 chosen specialties. Although shorter courses are still available to train the rural  
46 workforce, five-year undergraduate programs based at the university are now the  
47 norm to enter into vocational training. Nonetheless, general practice is a relatively  
48 new clinical discipline in China and there are currently few general practice  
49 departments in medical schools.<sup>14</sup> Hence, the exposure to general practice and primary  
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3 care teaching at the undergraduate level is minimal and the discipline has a low status  
4 amongst other clinical disciplines.  
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11 At the vocational training level, the emphasis has been on implementing the new  
12 policy of establishing primary care in a very short time span through re-orientation of  
13 specialists to general practice, initially by “on-the-job training” and later replaced by  
14 “job-transfer” training, and training of new general practitioners (GPs) since 2011  
15 with a three-year structured program with 2.5 years in hospital rotations followed by  
16 six months in the community. “Job-transfer training” is a one-year long programme  
17 aimed at the less qualified doctors currently working at CHCs or those who have not  
18 undergone “on-the-job training” to enhance their theoretical knowledge of general  
19 practice and practical clinical skills through a combination of lectures, hospital  
20 rotations and community-based placements.  
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33 Continuous medical education (CME) aimed at maintaining, developing and  
34 enhancing medical providers’ professional knowledge, skills and interpersonal  
35 capacity to keep abreast of professional lives, is an essential element to maintain  
36 quality of care in this new system<sup>15,16</sup> and CME is compulsory for ongoing  
37 registration in China. According to the “Twelfth 5-year plan”,<sup>17</sup> 100% of senior, 95%  
38 of mid-grade; and 80% of junior health professionals at provincial and city levels  
39 should achieve the required CME targets over two years. For staff working in western  
40 and peripheral regions of China, these targets were reduced to 95%, 80% and 70%  
41 respectively to reflect the phased development of primary care in these large and  
42 dispersed regions of the country. The hierarchy of the titles can only be achieved after  
43 passing the qualifying examination and fulfilling a number of stringent criteria  
44 including CME requirements, written examinations and publication of research  
45 manuscripts. This study aimed to evaluate the current organization and manpower of  
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CHCs in China, as well as the training (especially the content and delivery of CME) of health professionals within primary care in China.

### Methods

A nationwide representative survey using a stratified randomized sample was conducted amongst CHC medical professionals between September and December 2015. China was divided into three administrative regions: central, eastern and western. Two provinces were randomly selected from each region; and from these, the capital city and two district-level cities were selected at random. In addition, two of the four major municipalities (Beijing, Shanghai, Chongqing and Tianjin) were also selected at random and included in the sample. In total, twenty cities were chosen from the provinces and municipalities combined. From these, nine CHCs were randomly selected from each city (with an urban-to-suburban ratio of 2:1), giving a total of 180 CHCs. The lead clinicians and all doctors and nurses (excluding traditional Chinese herbalists) with direct patient contact from these selected CHCs were invited to participate in the survey.

The local chairpersons of the General Practitioner Associations of the six selected provinces and two selected municipalities were contacted, whom in turn, contacted the randomly selected CHCs. Training on how to distribute and complete the survey questionnaire was arranged for the coordinators of each province or municipality prior to the study. These coordinators were responsible for tracking and collecting the questionnaires. Collected data was entered and cleaned using EPIDATA 3.1. A data entry team was responsible for data input and appointed personnel for auditing and quality control.

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3 The study consisted of two questionnaires, one for the lead clinicians and another for  
4 CHC staff (i.e. doctors and nurses). The former (Appendix 1) covered current clinical  
5 set-up, range of services and staff composition, community characteristics and patient  
6 demographics; as well as information on CME organized at the clinic. In this survey  
7 we asked the lead clinician to use their own records to estimate the median population  
8 size of the catchment area and number of patient contacts in the past year. In the  
9 conditions, training experience, CME participation and their willingness to conduct  
10 certain testing services. CME organized by CHCs was compared with actual  
11 participation reported by the CHC staff. These surveys were pilot-tested twice on  
12 three CHCs and twenty-five practitioners with modifications made accordingly.  
13 Detailed methodology and, availability and use of primary care facilities is reported  
14 elsewhere .<sup>18</sup>  
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29 Descriptive analyses were conducted for percentages and frequencies of key  
30 parameters. Confidence intervals for the sample proportions were calculated using the  
31 Agresti-Coull (adjusted Wald) method. CME participation and content were broken  
32 down according to the three administrative districts which have different requirements  
33 for CME participation. Multivariable logistic regression was used to explore the staff  
34 characteristics as the independent factors (with odds ratios (OR) and 95% confidence  
35 intervals (CI) calculated) associated with participation of CME by the health  
36 professionals after adjusting for gender, medical specialty, years working in the CHC,  
37 job title and education level. All significance tests were two-tailed and those with a p-  
38 value less than 0.05 were considered statistically significant. Data were analyzed  
39 using STATA (StataCorp. 2013. *Stata Statistical Software: Release 13*. College  
40 Station, TX: StataCorp LP).  
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## 52 53 54 **Results**



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3 One hundred and forty-nine out of the 189 CHCs contacted provided data on their  
4 CHC (79% response rate). Figure 1 shows the distribution of CHCs surveyed in China.  
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6 Of the 4,146 health professionals invited, 1,734 doctors and 1,846 nurses completed  
7 the survey giving a response rate of 86%.  
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14 The median population size of the catchment area of each CHC was 50,000 people  
15 (interquartile range (IQR) 30,000 to 96,000) with a migrant population of 11,100  
16 (IQR 5,000-30,000). The median patient contacts per year was 41,100 (IQR 12,000 to  
17 163,600). Table 1 provides the demographics of CHC staff. The median age of CHC  
18 doctors and nurses were young at 38 and 31 years of age, respectively. Women  
19 accounted for 61% of the doctors and nearly all the nurses, with a nurses-to-doctor  
20 ratio of 1.6. About half of the doctors had bachelor degrees or above, yet only 10% of  
21 them had acquired senior titles. Despite the fact that all were practising as GPs, only  
22 half of them were actually registered as general practitioners. Doctors and nurses had  
23 worked in general practice for a median of 14 years and 9 years, respectively.  
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36 Table 2 shows the range and frequency of reported on-site CME and CME  
37 participation. CME activities were held by nearly all CHCs (97.2%), nearly two-thirds  
38 (62.9%) holding CME sessions monthly or more frequently. According to the lead  
39 clinicians, all health professionals would have participated in CME, more frequently  
40 than managers (95%) and other health professionals (88%). However, when this  
41 figure was compared with the individual health professionals' survey, only about 90%  
42 of health professionals actually reported participating in CME. The type of in-house  
43 CME activities reported were diagnostic and treatment guidelines discussion (97.2%),  
44 management updates (84.8%) and case discussions (84.2%). Notably nurses reported  
45 much less involvement in these CME activities (57.3-64.1%).  
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3 Table 3 shows CME participation for different types of health professionals in the  
4 three administrative districts. Despite CME participation being extremely high  
5 (ranging between 86% to 100% ), those in the central and eastern regions fell short of  
6 the targets set by the State. In contrast to what was expected by the government, there  
7 was no significant difference of CME participation by GPs in the three administrative  
8 regions and CME participation was actually commoner among junior doctors in the  
9 western and peripheral regions compared to the central and eastern regions (p=0.039).  
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20 Table 4 summarizes the multivariate analysis of health professionals' characteristics  
21 with CME participation. Amongst doctors, CME participation was commoner among  
22 older doctors (adjusted odds ratios (aOR) 1.04 per year), women (aOR 1.7), those  
23 registered as GPs (aOR 3.0) and those with an intermediate or senior job title (aOR  
24 2.2). Amongst nurses, CME participation was commoner among those with bachelor  
25 degrees (aOR 2.9), with longer experience working in general practice (aOR 1.1 per  
26 year) or with an intermediate or senior job title (aOR 2.2).  
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### 37 Discussion

38 This large representative study of China's CHCs examines the current primary care  
39 workforce and finds it is predominantly staffed by young female health professionals,  
40 with only half of doctors holding a bachelor degree or higher, or registered as a GP.  
41 The relatively low nurse-to-doctor ratio may reflect the focus of care where doctor-  
42 centred approach in the traditional medical model is preferred. The ratio was far from  
43 the international standard of approximately three nurses per doctors as recommended  
44 by World Health Organization (WHO).<sup>19</sup> Evidence exists that an undersupply of  
45 nurses could result in inefficient allocation of resources.<sup>20</sup>  
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56 For historical reason, many practicing health professionals at CHCs do not have a  
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3 bachelor degree. Indeed, our study shows just over half of the doctors and under a  
4 third of the nurses working in primary care have a bachelor degree. This may  
5 contribute in part to the perception of poor training and poor quality in primary care.  
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7 The quality of health care should be based upon the quality of the workforce rather  
8 than just increasing the sheer quantity of staff as it has been the focus of China's  
9 policy on development of primary care thus far. The education level and title seniority  
10 through examination are considered important indicators of professional standards and  
11 competency. Nurses who have a higher level of education provide better health care  
12 and safety for their patients.<sup>21</sup>  
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24 In China, due to the short history of primary care development, many senior doctors  
25 were previously either public health physicians or specialist who converted to being  
26 GPs and were given the task of setting up CHCs. Previously "on-the-job" and now  
27 "job-transfer" training is offered to the specialists who have converted to work as GPs  
28 before sitting the qualifying examination. In order to attract them to primary care,  
29 they are allowed to keep up to three specialties on their registration but in our survey,  
30 only 47% of the doctors chose to register general practice as their prime registration.  
31 Again we confirm that the CME participation rates for those registered as GPs are  
32 higher than those still registered as a specialist. Further, 97% of staff members with  
33 intermediate and senior level job titles participated in CME, which accounted for 39%  
34 of all CHC health professionals (52% of GPs and 29% of nurses). An advancement in  
35 job titles may provide a sense of ownership and autonomy,<sup>9</sup> and thus was identified as  
36 an independent factor in the participation of CME in our study.  
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51 CME is a requirement for practicing professionals in many countries including China  
52 in order to maintain medical knowledge and skills.<sup>22</sup> Doctors who do not participate in  
53 CME have lower confidence when making clinical decisions.<sup>21</sup> Although it is  
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3 encouraging to see nearly all CHC staff had participated in CME, one-third of CHCs  
4 organize on-site CME activities once every quarter or even once a year, which is far  
5 from satisfactory. A Cochrane review suggests that CME should be accessible within  
6 health professionals' own clinical communities.<sup>23</sup> Other forms of CME might include  
7 attending professional conferences, research workshops or distance learning courses  
8 so long as they have been approved by the postgraduate center in their respective city.  
9 Learning objectives must be tailored beyond meeting the staff's CME requirements  
10 where each CHC or jointly in a locality should take into account the local context and  
11 needs e.g. the local disease pattern and epidemiology, and to provide the necessary  
12 training and support to their staff to address the skill-mix to deliver the service.  
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24 In China, both doctors and nurses have to fulfil at least 25 credits of approved CME  
25 every year and are reaccredited every two years. Arguably, reflective learning,  
26 meeting self-defined learning objectives and auditing clinical performance with  
27 practitioners expected to demonstrate certain competencies in managing the patients  
28 independently, would be more appropriate in quality improvement rather than time-  
29 based training.<sup>21</sup> Lack of time and appropriate resources have been reported as  
30 obstacles for CME participation in China.<sup>24</sup> Alternatives such as self-directed searches  
31 in the medical literature or medical websites, or structured resources on the internet  
32 (e.g. BMJ learning) or medical journals, exist to meet their learning needs.<sup>25,26</sup>  
33 Nonetheless these alternatives are limited by the motivation and skills required to  
34 perform these searches effectively as well as the availability and accessibility  
35 (including the language barrier) of these resources.  
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49 Our study suggests that 97.2% of CHCs hold discussions and learning sessions about  
50 treatment protocols and 84.8% on disease updates. If used well, evidence-based  
51 medicine can aid health professionals in making the most appropriate therapeutic  
52 decisions for individual patients and conditions at the clinical level. However, rapid  
53 advancements in therapeutic methods and multiple guidelines from both local and  
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3 international agencies have made it difficult for health professionals to follow them  
4 closely. Primary healthcare staff can learn and incorporate these new updates and  
5 guidelines into their clinical practices only when they engage in the dissemination and  
6 implementation at the early stage, and have the support of their senior colleagues.  
7 Moreover, GPs need to take the opportunities provided by CME to share difficulties  
8 when dealing with individual patients and build the team to cope with different  
9 professional environments.<sup>27</sup> Significant event audit is a regular and compulsory part  
10 of annual appraisal for all doctors in the NHS in the UK.<sup>28</sup>  
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21 Our survey found that the current CME participation fell short of the overall 95%  
22 standard from the “Twelfth Five Years Plan”,<sup>15</sup> where 92% of doctors and 89% of  
23 nurses surveyed reported regular CME participation. However, contrary to what was  
24 believed by the policymakers (as reflected in the targets set), participation rates for  
25 doctors from the Western and peripheral region CME not only exceeded the target,  
26 but also those of junior titles participated more than their counterparts in the other  
27 regions, which suggested such regional differentiation is unnecessary.  
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### 38 **Conclusion**

39 This is the first representative study examining the current primary care workforce  
40 and their continuous education in mainland China. The high participation rates of  
41 CME amongst health professionals in CHCs, if used well, could maintain high  
42 standards of practice amongst the primary care work force in China. The current  
43 emphasis of CME is on updating knowledge of diseases and discussion of therapeutic  
44 protocols. Those registered as GPs have better CME participation rates than those  
45 who registered as specialists but there are no significant differences among CME  
46 participation rates in CHC staff (except in junior doctors) in three regions of China.  
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### **Conflict of Interest**

The authors declare that they have no competing interests to declare.

### **Ethical Considerations**

Ethics Committee approvals from a local board (HKU/HAW IRB: UW15-350) and the World Health Organization Regional Office for the Western Pacific (2016.4.CHN.1.HSI) were obtained.

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3 implementation. We also thank all the CHCs and doctors/ nurses who have engaged in  
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5 the survey.  
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### 10 **Contributorship Statement**

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12 William CW Wong designed the study and the questionnaire, and wrote up the report.  
13 ShanZhu Zhu led the team and oversaw the implementation, and liaised with different  
14 Chinese GP Associations. Jason Ong conducted the data analysis, and drafted the  
15 results of the manuscript with William CW Wong. MingHui Peng implemented the  
16 study and helped some of the data analysis. Cindy L. K. Lam, Michael R Kidd and  
17 Martin Roland advised on the study design and questionnaire, and commented on the  
18 reports. SunFang Jiang led the team and oversaw the implementation, led the pilot  
19 testing as well as implementation of the study, took part in the discussion and  
20 modification of the design and the questionnaire.  
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**Table 1.** Basic characteristics and training of CHC health professionals

Variables	DOCTORS		NURSES	
	n/N	% (95%CI)	n/N	% (95%CI)
Median Age (IQR)		38 (32-46)		31 (26-39)
<b>Gender</b>				
Female	1,025/ 1675	61.2 (58.8- 63.5)	1,793/ 1803	99.4 (99.0-99.7)
<b>Education</b>				
Below associate degree	202/ 1724	11.7 (10.2- 13.3)	382/ 1831	20.9 (19.0-22.8)
Associate degree*	582/ 1724	33.8 (31.5- 36.0)	920/ 1831	50.2 (47.9-52.6)
Bachelor degree or	940/ 1724	54.5 (52.1- 56.9)	529/ 1831	28.9 (26.8-31.0)

higher	1724	56.9)	1831	
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Variables	CHCs	DOCTORS	NURSES
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Job title				
Senior	180/ 1711	10.5 (9.1-12.1)	46/ 1815	2.5 (1.9-3.4)
Intermediate	705/ 1711	41.2 (38.9- 43.6)	471/ 1815	26.0 (23.9-28.0)
Junior	683/ 1711	39.9 (37.6- 42.3)	1,158/ 1815	63.8 (61.5-66.0)
None	143/ 1711	8.4 (7.1-9.8)	140/ 1815	7.7 (6.5-9.0)
Registered Speciality				
Integrative Medicine	145/ 1700	8.5 (7.2-10.0)	2/ 1834	0.1 (0.0-0.4)
General practice	799/ 1700	47.0 (44.6- 49.4)	85/ 1834	4.6 (3.7-5.7)
Other Specialty	454/ 1700	26.7 (24.6- 28.9)	19/ 1834	1.0 (0.6-1.6)
Nurse	23/ 1700	1.4 (0.9-2.0)	1712/ 1834	93.3 (92.1-94.4)
None	75/ 1700	4.4 (3.5-5.5)	30/ 1834	1.6 (1.1-2.3)
Other	295/ 1700	17.4 (15.6- 19.2)	18/ 1834	1.0 (0.6-1.5)
Median Years working in above speciality (IQR)	14 (7-23)		9 (4-18)	

\* Associate degree refers to 2-years health related sub-degree equivalent to a physician assistant

CI=Confidence interval, IQR = interquartile range

**Table 2.** Continuous medical education organised and undertaken by CHC staff

	n/N	% (95%CI)	n/N	% (95%CI)	n/N	% (95%CI)
<b>Organisation of CME activities</b>						
Continuous Medical education	140/144	97.2 (93.0-99.2)				
<b>Frequency of CME organised at CHCs</b>						
Yearly	16/148	10.8 (6.3-17.0)	-	-	-	-
Quarterly	25/148	16.9 (11.2-23.9)	-	-	-	-
Bimonthly	13/148	8.8 (4.8-14.6)	-	-	-	-
Monthly	77/148	52.0 (43.7-60.3)	-	-	-	-
Biweekly	15/148	10.1 (5.8-16.2)	-	-	-	-
Weekly	2/148	1.4 (0.2-4.8)	-	-	-	-
<b>Who involves in learning activities organised by CHC</b>						
Managers	140/145	96.6 (92.0-99.0)	-	-	-	-
Doctors	147/147	100.0 (97.5-100.0)	1455/1588	91.6 (90.2-92.9)		
Nurses	146/146	100.0 (97.5-100.0)	-	-	1502/1683	89.2 (87.7-90.7)
Other medical staff	126/142	88.7 (82.3-93.4)	-	-	-	-
<b>Types of CME activities</b>						
Diagnostic and treatment guideline and discussion	141/145	97.2 (93.1-99.2)	1263/1449	87.2 (85.3-90.7)	894/1395	64.1 (61.5-66.6)
Management updates	123/145	84.8 (77.9-90.2)	1116/1384	80.6 (78.5-82.7)	872/1389	62.8 (60.2-65.3)
Case discussions	117/139	84.2 (77.0-93.0)	1084/1371	79.1 (76.8-81.2)	768/1341	57.3 (54.6-59.9)

**Table 3.** CME participation for different types of health professionals according to the three administrative districts

	CENTRAL		WESTERN & PERIPHERIAL		EASTERN		$\chi^2$	<i>p</i> -value
	n/N	% (95%CI)	n/N	% (95%CI)	n/N	% (95%CI)		
<b>Health professionals</b>	701/786	89.2 (86.8-91.3)	916/1018	90.0 (88.0-91.8)	1519/1655	91.8 (90.4-93.1)	5.04	0.08
Doctors	370/407	90.9 (87.7-93.5)	424/462	91.8 (88.9-94.1)	751/807	93.1 (91.1-94.7)	1.89	0.39
Nurse	331/379	87.3 (83.6-90.5)	492/556	88.5 (85.5-91.0)	768/848	90.6 (88.4-92.4)	3.31	0.19
<b>Job titles</b>								
Intermediate & Senior	270/282	95.7 (92.7-97.8)	280/290	96.9 (93.8-98.3)	764/786	97.2 (95.8-98.2)	1.46	0.48
Junior	399/456	87.5 (84.1-90.4)	525/569	92.3 (89.8-94.3)	681/763	89.3 (86.8-91.4)	6.64	0.036
<b>Education level</b>								
Bachelor & higher	380/442	86.0 (82.4-89.1)	646/731	88.4 (85.8-90.6)	739/829	89.1 (86.8-91.2)	2.83	0.24
Associate degree and below	316/339	93.2 (90.0-95.7)	265/282	94.0 (90.5-96.4)	770/814	94.6 (92.8-96.0)	0.85	0.66
<b>Registered specialty</b>								
GPs	146/151	96.7 (92.3-98.9)	143/143	100 (97.5-100)	464/487	95.0 (93.0-97.0)	5.73	0.057
Specialists	217/246	88.2 (83.5-92.0)	272/308	88.3 (84.2-91.7)	281/316	88.9 (84.9-91.2)	0.087	0.96

**Table 4** Crude and adjusted odds ratios for participation in CME by health professionals

Participation in CME for doctors (n=1587)	Crude OR (95% CI)	p value	Adjusted OR* (95% CI)	p value
Age	1.08 (1.06-1.11)	<0.01	1.04 (1.02-1.07)	<0.01
Female	1.86 (1.24-2.79)	<0.01	1.72 (1.12-2.63)	0.01
Graduate degree or above	1.45 (1.02-2.08)	0.04	-	-
GP specialty	4.24 (2.69-6.67)	<0.01	2.97 (1.83-4.81)	<0.01
Years working in occupation	1.07 (1.04-1.09)	<0.01	-	-
Senior or intermediate job title (junior title as reference)	4.22 (2.74-6.48)	<0.01	2.16 (1.31-3.56)	<0.01

Participation in CME for nurses (n=1683)	Crude OR (95% CI)	p value	Adjusted OR (95% CI)	p value
Age	1.09 (1.06-1.11)	<0.01	-	
Graduate degree or above	3.29 (2.10-5.16)	<0.01	2.85 (1.79-4.55)	<0.01
Years working in occupation	1.10 (1.07-1.13)	<0.01	1.08 (1.05-1.11)	<0.01
Senior or intermediate job title (junior title as reference)	1.59 (1.06-2.11)	<0.01	2.16 (1.17-4.00)	0.01

\* Adjusted for gender, medical specialty, years working in the CHC, job title and education level

CI = confidence interval, OR = odds ratio

## Reporting checklist

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# BMJ Open

## Primary Care Workforce and Continuous Medical Education in China: Lessons to learn from a Nationwide Representative Survey

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# Primary Care Workforce and Continuous Medical Education in China: Lessons to learn from a Nationwide Representative Survey

**Short title:** Workforce and continuous medical education in primary care in China

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**Abstract****Objectives**

This study aimed to examine the education and training background of Chinese community health centres (CHC) staff, continuous medical education (CME) and factors affecting participation in CME.

**Design** Cross-sectional survey

**Setting** Community health centres (CHCs)

**Participants** All doctors and nurses working in selected CHCs (excluding those solely practising traditional Chinese Medicine)

**Main Outcome Measures** CME recorded by CHCs and self-reported CME participation

**Methods**

A stratified random sample of CHCs based on geographical distribution and 2:1 urban-suburban ratio was selected covering three major regions of China. Two questionnaires, one for lead clinicians and another for frontline health professionals, were administered between September-December 2015, covering the demographics of clinic staff, staff training and CME activities.

**Results**

149 lead clinicians (response rate 79%) and, 1,734 doctors and 1,846 nurses completed the survey (response rate 86%). 54.5% of the doctors had a bachelor degree and only 47% were registered as general practitioners (GPs). 10.5% of doctors carried senior titles. Few nurses (4.6%) had training in primary care. 91.6% of doctors and 89.2% of nurses reported participating in CME. CME participation in doctors was more commonly reported by older doctors, females, those who were registered as a GP and those with intermediate or senior job titles. CME participation in nurses was commoner among those with a bachelor degree or intermediate/senior job titles, or those with longer working experience in the CHC.

### **Conclusion**

This representative survey confirms only half of doctors have bachelor degrees or are registered as GPs as their prime registration in the primary care workforce in China. The vast majority of CHC staff participated in CME but there is room for improvement in how CME is organised.

**Key words** Continuous medical education, Training, Quality of care, Primary care, China

### **Strengths and limitations**

This study was the first study to survey the CME situation of a representative sample of medical staff in CHCs in mainland China reported in the international literature. We focused on doctors and nurses working in CHCs, who are the core of the primary care workforce. It has been reported that the majority of CME programmes in China were based on the concept of institutionally-oriented planning, dictated by the interests of these organisation rather than the needs of learners<sup>1</sup>. Therefore, our study provides a useful baseline of the frequency and types of locally-organised CME activities across a large number of CHCs. The main limitation of this study is that we focused on CME activities that were organised by CHCs but arguably those were the most commonly attended by the staff of individual CHCs. We did not evaluate the quality of CME being delivered nor whether observable health improvements had resulted from CME participation. Moreover, social desirability might constitute a threat in such self-reported surveys especially if participation in the survey was encouraged by the supervisors. These could be the subject of future research through in-depth qualitative interviews of CHC staff and focused evaluations of CME programs in China.

## Introduction

The importance of a strong primary care system based on first contact access and provision of person-focused comprehensive care with continuity and coordination, is widely accepted.<sup>2-7</sup> Despite a strong primary care system being repeatedly shown to be an effective approach at reducing health inequity and achieving universal health coverage,<sup>3</sup> many countries have yet to develop a robust primary healthcare system. Instead, primary care services are often characterized by inadequate resources and facilities, lack of appropriate training for their medical staff, variable quality in delivery of care and fragmented care.<sup>8</sup> In China, these problems were further compounded by economic and healthcare reforms in the 1980s which involved fiscal decentralization, commercialization of medical services, and underfunding of the public healthcare sector. These turned a generation of health professionals and the general public to rely heavily on high-tech diagnostics, expensive drugs and specialist procedures.<sup>9,10</sup> These factors reinforced unrealistic patient expectations focused on specialist diagnostic aids and procedures, while alienating cost-efficient primary care that would better suit the nation's health needs.<sup>11</sup>

In 2009, the Chinese government responded to these problems and committed themselves to re-establishing primary healthcare.<sup>12</sup> According to Health & Family Planning Commission, expenditure on primary care has reached USD17.74 billion (1USD=¥6.20) and accounted for approximately 30% of the public spending on health in 2014.<sup>13</sup> In fewer than ten years, the Chinese Government has succeeded in establishing a primary care infrastructure composed mainly of rural township centres, village clinics and community health centres (CHCs) in cities. By 2014, 8,669 CHCs were established, employing over 300,000 health professionals, the great majority of which were from the established rural practices. However, the historical image of 'barefoot doctors' who had worked in rural regions since the 1950s, criticism of the

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3 healthcare system by end-users, and negative publicity by the media have all led to a  
4 breakdown of trust between patients and health professionals, including in the newly-  
5 revamped primary care system.<sup>10</sup> This problem appears particularly pronounced in the  
6 cities where patients have greater choice and easier access to hospitals. One of the  
7 major problem is that CHC health professionals (doctors and nurses included) are  
8 regarded as poorly qualified and trained, and CHCs are poorly resourced, providing  
9 “low tech” facilities.<sup>14</sup>  
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20 In the past, medical courses were offered by a variety of colleges, vocational training  
21 schools and universities, ranging from 2-8 years of training. Graduates of these  
22 courses would have to sit and pass board examinations to be registered for their  
23 chosen specialties. Although shorter courses are still available to train the rural  
24 workforce, five-year undergraduate programs based at the university are now the  
25 norm to enter into vocational training. Nonetheless, general practice is a relatively  
26 new clinical discipline in China and there are currently few general practice  
27 departments in medical schools.<sup>15</sup> Hence, the exposure to general practice and primary  
28 care teaching at the undergraduate level is minimal and the discipline has a low status  
29 amongst other clinical disciplines.  
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43 At the vocational training level, the emphasis has been on implementing the new  
44 policy of establishing primary care in a very short time span through re-orientation of  
45 specialists to general practice, initially by “on-the-job training” and later replaced by  
46 “job-transfer” training. “Job-transfer training” is a one-year long programme aimed at  
47 the less qualified doctors currently working at CHCs or those who have not  
48 undergone “on-the-job training” which entailed a series of short courses to enhance  
49 their theoretical knowledge of general practice and practical clinical skills through a  
50 combination of lectures, hospital rotations and community-based placements. Since  
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3 2011 this has been replaced by a three-year structured program with 2.5 years in  
4 hospital rotations followed by six months in the community.  
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11 Continuous medical education (CME) aimed at maintaining, developing and  
12 enhancing medical providers' professional knowledge, skills and interpersonal  
13 capacity to keep abreast of professional lives, is an essential element to maintain  
14 quality of care in this new system<sup>16,17</sup> and CME is compulsory for ongoing  
15 registration in China. These CHC staff are required to participate in CME organised  
16 by training institutions at national, provincial, municipal, district and center level, and  
17 they have to fulfil at least 25 credits of approved CME every year which is accredited  
18 every two years. According to the "Twelfth 5-year plan",<sup>18</sup> 100% of senior, 95% of  
19 mid-grade; and 80% of junior health professionals at provincial and city levels should  
20 achieve the required CME targets over two years. For staff working in western and  
21 peripheral regions of China, these targets were reduced to 95%, 80% and 70%  
22 respectively to reflect the phased development of primary care in these large and  
23 dispersed regions of the country. The hierarchy of the titles can only be achieved after  
24 passing the qualifying examination and fulfilling a number of stringent criteria  
25 including CME requirements, written examinations and publication of research  
26 manuscripts. This study aimed to evaluate the current organization and manpower of  
27 CHCs in China, as well as the training (especially the content and delivery of CME)  
28 of health professionals within primary care in China.  
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## 47 **Methods**

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49 A nationwide representative survey using a stratified randomized sample was  
50 conducted amongst CHC medical professionals between September and December  
51 2015. China was divided into three administrative regions: central, eastern and  
52 western. Two provinces were randomly selected from each region; and from these, the  
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3 capital city and two district-level cities were selected at random. In addition, two of  
4 the four major municipalities (Beijing, Shanghai, Chongqing and Tianjin) were also  
5 selected at random and included in the sample. In total, twenty cities were chosen  
6 from the provinces and municipalities combined. From these, nine CHCs were  
7 randomly selected from each city (with an urban-to-suburban ratio of 2:1), giving a  
8 total of 180 CHCs. The lead clinicians and all doctors and nurses (excluding  
9 traditional Chinese herbalists) with direct patient contact from these selected CHCs  
10 were invited to participate in the survey.  
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21 The local chairpersons of the General Practitioner Associations of the six selected  
22 provinces and two selected municipalities were contacted, whom in turn, contacted  
23 the randomly selected CHCs. Training on how to distribute and complete the survey  
24 questionnaire was arranged for the coordinators of each province or municipality prior  
25 to the study. These coordinators were responsible for tracking and collecting the  
26 questionnaires. Collected data was entered and cleaned using EPIDATA 3.1. A data  
27 entry team was responsible for data input and appointed personnel for auditing and  
28 quality control.  
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39 The study consisted of two questionnaires, one for the lead clinicians and another for  
40 CHC staff (i.e. doctors and nurses). The former (Appendix 1) covered current clinical  
41 set-up, range of services and staff composition, community characteristics and patient  
42 demographics; as well as information on CME organized at the clinic. In this survey  
43 we asked the lead clinician to use their own records to estimate the median population  
44 size of the catchment area and number of patient contacts in the past year. In the  
45 second survey, we asked the frontline health professionals about their training  
46 experience, CME participation and their willingness to conduct certain testing  
47 services. CME organized by CHCs was compared with actual participation reported  
48 by the CHC staff. These surveys were pilot-tested twice on three CHCs and twenty-  
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3 five practitioners with modifications made accordingly. Detailed methodology and,  
4 availability and use of primary care facilities is reported elsewhere.<sup>19</sup>  
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10 Descriptive analyses were conducted for percentages and frequencies of key  
11 parameters. Confidence intervals for the sample proportions were calculated using the  
12 Agresti-Coull (adjusted Wald) method. CME participation and content were broken  
13 down according to the three administrative districts which have different requirements  
14 for CME participation. Univariate logistic regression was used to explore the staff  
15 characteristics as the independent factors (with crude odds ratios (OR) and 95%  
16 confidence intervals (CI) calculated) associated with participation of CME by the  
17 health professionals after adjusting for gender, medical specialty, years working in the  
18 CHC, job title and education level. We also examined factors related to the clinical  
19 set up, range of services offered, staff composition, community characteristics and  
20 patient demographics (see Appendix 1 for full list of variables from questionnaire)  
21 and present in the paper factors which were statistically significant. All variables with  
22 p values <0.10 was included in the multivariate model and through backward  
23 elimination, we report the final variables (with adjusted odds ratios (AOR)) with a p-  
24 value less than 0.05 as statistically significant by convention. We adjusted the final  
25 model for age, gender, medical specialty, years working in the CHC, job title and  
26 education level. Data were analyzed using STATA (StataCorp. 2013. *Stata Statistical  
27 Software: Release 13*. College Station, TX: StataCorp LP).  
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## 47 **Results**

48 One hundred and forty-nine out of the 189 CHCs contacted provided data on their  
49 CHC (79% response rate). **Figure 1** shows the distribution of CHCs surveyed in  
50 China. The median number of fulltime general practitioners working at CHC was 8  
51 (interquartile range (IQR) 4-14) and fulltime nurses was 13 (IQR 8-12). Of the 4,146  
52 health professionals invited, 1,734 doctors and 1,846 nurses completed the survey  
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3 giving a response rate of 86%. A very small percentage of them might have double  
4 qualifications in medicine and nursing.  
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11 The median population size of the catchment area of each CHC was 50,000 people  
12 (IQR 30,000 to 96,000) with a migrant population of 11,100 (IQR 5,000-30,000). The  
13 median patient contacts per year was 41,100 (IQR 12,000 to 163,600). Table 1  
14 provides the demographics of CHC staff. The median age of CHC doctors and nurses  
15 were young at 38 and 31 years of age, respectively. Women accounted for 61% of the  
16 doctors and nearly all the nurses, with a nurses-to-doctor ratio of 1.6. 54.5% of the  
17 doctors had bachelor degrees or above, yet only 10.5% of them had acquired senior  
18 titles. Despite the fact that all were practising as general practitioners (GPs), only 47%  
19 were actually registered as one. Doctors and nurses had worked for a median of 14  
20 years and 9 years, respectively.  
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32 Table 2 shows the range and frequency of reported on-site CME and CME  
33 participation. CME activities were held by nearly all CHCs (97.2%), nearly two-thirds  
34 (63.5%) holding CME sessions monthly or more frequently. According to the lead  
35 clinicians, all health professionals would have participated in CME, more frequently  
36 than managers (95%) and other health professionals (88%). However, when this  
37 figure was compared with the individual health professionals' survey, 91.6% of  
38 doctors and 89.2% of nurses reported participating in CME. The type of in-house  
39 CME activities reported were clinical guidelines discussion (97.2%), management  
40 updates e.g. journal clubs (84.8%) and case discussions (84.2%). Notably nurses  
41 reported much less involvement in the variety of CME activities (57.3-64.1%).  
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54 Table 3 shows CME participation for different types of health professionals in the  
55 three administrative districts. Despite CME participation being extremely high  
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(ranging between 86% to 100% ), those in the central and eastern regions fell short of the targets set by the State. In contrast to what was expected by the government, there was no significant difference of CME participation by GPs in the three administrative regions and CME participation was actually commoner among junior doctors in the western and peripheral regions compared to the central and eastern regions ( $p=0.036$ ).

Table 4 summarizes the multivariate analysis of health professionals' characteristics with CME participation. Amongst doctors, CME participation was commoner among older doctors (adjusted odds ratios (aOR) 1.04 per year), women (aOR 1.7), those registered as GPs (aOR 3.0) and those with an intermediate or senior job title (aOR 2.2). Amongst nurses, CME participation was commoner among those with bachelor degrees (aOR 2.9), with longer experience working in general practice (aOR 1.1 per year) or with an intermediate or senior job title (aOR 2.2).

## Discussion

This large representative study of China's CHCs examines the current primary care workforce and finds it is predominantly staffed by young female health professionals, with only half of doctors holding a bachelor degree or higher, or registered as a GP. The relatively low nurse-to-doctor ratio may reflect the focus of care on doctor-centred approach in the traditional medical model. Indeed the lead physicians reported on average there were 1-2 pharmacists, physiotherapists, laboratory technicians or radiographers but clinical psychologists or medical social workers were uncommon.<sup>13</sup> The ratio was far from the international standard of approximately three nurses per doctors as recommended by World Health Organization (WHO).<sup>20</sup> Evidence exists that an undersupply of nurses could result in inefficient allocation of resources.<sup>21</sup>

For historical reasons, many practicing health professionals at CHCs do not have a

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3 bachelor degree.<sup>15</sup> Indeed, our study shows just over half of the doctors and under a  
4 third of the nurses working in primary care have a bachelor degree. This may  
5 contribute in part to the perception of poor training and poor quality in primary care.  
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7 The quality of health care should be based upon the quality of the workforce rather  
8 than just increasing the sheer quantity of staff as it has been the focus of China's  
9 policy on development of primary care thus far. The education level and title seniority  
10 through examination are considered important indicators of professional standards and  
11 competency. Nurses who have a higher level of education provide better health care  
12 and safety for their patients.<sup>22</sup>  
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24 In China, due to the short history of primary care development, many senior doctors  
25 were previously either public health physicians or specialist who converted to being  
26 GPs and were given the task of setting up CHCs. Previously "on-the-job" and now  
27 "job-transfer" training is offered to the specialists who have converted to work as GPs  
28 before sitting the qualifying examination. In order to attract them to primary care,  
29 they are allowed to keep up to three specialties on their registration but in our survey,  
30 only 47% of the doctors chose to register general practice as their prime registration.  
31 We confirm that the CME participation rates for those registered as GPs are higher  
32 than those still registered as a specialist. Further, 97% of staff members with  
33 intermediate and senior level job titles participated in CME, which accounted for 39%  
34 of all CHC health professionals (52% of GPs and 29% of nurses). An advancement in  
35 job titles may provide a sense of ownership and autonomy,<sup>10</sup> and thus was identified  
36 as an independent factor in the participation of CME in our study.  
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51 CME is a requirement for practicing professionals in many countries including China  
52 in order to maintain medical knowledge and skills.<sup>23</sup> Doctors who do not participate in  
53 CME have lower confidence when making clinical decisions.<sup>22</sup> Although it is  
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3 encouraging to see nearly all CHC staff had participated in CME, one-third of CHCs  
4 organize on-site CME activities once every quarter or even once a year, which is far  
5 from satisfactory. A Cochrane review suggests that CME should be accessible within  
6 health professionals' own clinical communities.<sup>24</sup> Other forms of CME might include  
7 attending professional conferences, research workshops or distance learning courses  
8 so long as they have been approved by the postgraduate center in their respective city  
9 but the focus of CME undergone by doctors or nurses could be different and there is  
10 no fixed rules as how frequent they should attend these activities. Learning objectives  
11 must be tailored beyond meeting the staff's CME requirements where each CHC or  
12 jointly in a locality should take into account the local context and needs e.g. the local  
13 disease pattern and epidemiology, and to provide the necessary training and support to  
14 their staff to address the skill-mix to deliver the service.  
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28 Arguably, reflective learning, meeting self-defined learning objectives and auditing  
29 clinical performance with practitioners expected to demonstrate certain competencies  
30 in managing the patients independently, would be more appropriate in quality  
31 improvement rather than time-based training.<sup>22</sup> Lack of time and appropriate  
32 resources have been reported as obstacles for CME participation in China.<sup>25</sup>  
33 Alternatives such as self-directed searches in the medical literature or medical  
34 websites, or structured resources on the internet (e.g. BMJ learning) or medical  
35 journals, exist to meet their learning needs.<sup>26,27</sup> Nonetheless these alternatives are  
36 limited by the motivation and skills required to perform these searches effectively as  
37 well as the availability and accessibility (including the language barrier) of these  
38 resources.  
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51 Our study suggests that 97.2% of CHCs hold discussions and learning sessions about  
52 treatment protocols and 84.8% on disease updates. If used well, evidence-based  
53 medicine can aid health professionals in making the most appropriate therapeutic  
54 decisions for individual patients and conditions at the clinical level. However, rapid  
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advancements in therapeutic methods and multiple guidelines from both local and international agencies have made it difficult for health professionals to follow them closely. Primary healthcare staff can learn and incorporate these new updates and guidelines into their clinical practices only when they engage in the dissemination and implementation at the early stage, and have the support of their senior colleagues. Moreover, GPs need to take the opportunities provided by CME to share difficulties when dealing with individual patients and build the team to cope with different professional environments.<sup>28</sup> Significant event audit is a regular and compulsory part of annual appraisal for all doctors in the NHS in the UK.<sup>29</sup>

Our survey found that the current CME participation fell short of the overall 95% standard from the “Twelfth Five Years Plan”,<sup>16</sup> where 92% of doctors and 89% of nurses surveyed reported regular CME participation. Contrary to what was believed by the policymakers (as reflected in the targets set), participation rates for doctors from the Western and peripheral region CME not only exceeded the target, but evidently Western and peripheral region doctors of junior title had participated more than their counterparts in the other regions, which suggests such regional differentiation is unnecessary.

## Conclusion

In this study, it shows the high participation rates of CME amongst health professionals in CHCs, if used well, could maintain high standards of practice amongst the primary care workforce in China. CHCs could focus on improving nurses-to-doctor, bachelors-to-non-graduate and title seniority ratios as quality workforce improvements. There are disadvantages to continue to rely on conversion of specialists as a source of primary care workforce. At the same time, CME

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3 programmes should be decentralised and take on various forms to meet the local and  
4 individual needs whilst regional CME differentiation is unnecessary.  
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### 10 11 12 **Conflict of Interest**

13  
14 The authors declare that they have no competing interests to declare.  
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### 17 18 **Ethical Considerations**

19 Ethics Committee approvals from a local board (HKU/HAW IRB: UW15-350) and  
20 the World Health Organization Regional Office for the Western Pacific  
21 (2016.4.CHN.1.HSI) were obtained.  
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### 13 14 15 16 **Contributorship Statement**

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18 William CW Wong designed the study and the questionnaire, and wrote up the report.  
19  
20 ShanZhu Zhu led the team and oversaw the implementation, and liaised with different  
21 Chinese GP Associations. Jason Ong conducted the data analysis, and drafted the  
22 results of the manuscript with William CW Wong. MingHui Peng implemented the  
23 study and helped some of the data analysis. Cindy L. K. Lam, Michael R Kidd and  
24 Martin Roland advised on the study design and questionnaire, and commented on the  
25 reports. SunFang Jiang led the team and oversaw the implementation, led the pilot  
26 testing as well as implementation of the study, took part in the discussion and  
27 modification of the design and the questionnaire.  
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**Table 1.** Basic characteristics and training of CHC health professionals

Variables	DOCTORS		NURSES	
	n/N	% (95% CI)	n/N	% (95% CI)
Median Age (IQR)		38 (32-46)		31 (26-39)
<b>Gender</b>				
Female	1,025/ 1675	61.2 (58.8- 63.5)	1,793/ 1803	99.4 (99.0-99.7)
<b>Education</b>				
Below associate degree	202/ 1724	11.7 (10.2- 13.3)	382/ 1831	20.9 (19.0-22.8)
Associate degree*	582/ 1724	33.8 (31.5- 36.0)	920/ 1831	50.2 (47.9-52.6)
Bachelor degree or higher	940/ 1724	54.5 (52.1- 56.9)	529/ 1831	28.9 (26.8-31.0)
<b>Job title</b>				
Senior	180/ 1711	10.5 (9.1-12.1)	46/ 1815	2.5 (1.9-3.4)
Intermediate	705/ 1711	41.2 (38.9- 43.6)	471/ 1815	26.0 (23.9-28.0)
Junior	683/ 1711	39.9 (37.6- 42.3)	1,158/ 1815	63.8 (61.5-66.0)
None	143/ 1711	8.4 (7.1-9.8)	140/ 1815	7.7 (6.5-9.0)
<b>Registered Speciality</b>				
Integrative Medicine	145/ 1700	8.5 (7.2-10.0)	2/ 1834	0.1 (0.0-0.4)
General practice	799/ 1700	47.0 (44.6- 49.4)	85/ 1834	4.6 (3.7-5.7)
Other Specialty	454/ 1700	26.7 (24.6- 28.9)	19/ 1834	1.0 (0.6-1.6)
Nurse	23/ 1700	1.4 (0.9-2.0)	1712/ 1834	93.3 (92.1-94.4)
None	75/ 1700	4.4 (3.5-5.5)	30/ 1834	1.6 (1.1-2.3)
Other	295/ 1700	17.4 (15.6- 19.2)	18/ 1834	1.0 (0.6-1.5)
<b>Median Years working in above speciality (IQR)</b>	14 (7-23)		9 (4-18)	

\* Associate degree refers to 2-years health related sub-degree equivalent to a physician assistant

CI=Confidence interval, IQR = interquartile range

**Table 2.** Continuous medical education organised and undertaken by CHC staff

Variables	CHCs		DOCTORS		NURSES	
	n/N	% (95%CI)	n/N	% (95%CI)	n/N	% (95%CI)
<b>Organisation of CME activities</b>						
Continuous Medical education	140/144	97.2 (93.0-99.2)				
<b>Frequency of CME organised at CHCs</b>						
Yearly	16/148	10.8 (6.3-17.0)	-	-	-	-
Quarterly	25/148	16.9 (11.2-23.9)	-	-	-	-
Bimonthly	13/148	8.8 (4.8-14.6)	-	-	-	-
Monthly	77/148	52.0 (43.7-60.3)	-	-	-	-
Biweekly	15/148	10.1 (5.8-16.2)	-	-	-	-
Weekly	2/148	1.4 (0.2-4.8)	-	-	-	-
<b>Staff participating in CME</b>						
Managers	140/145	96.6 (92.0-99.0)	-	-	-	-
Doctors	147/147	100.0 (97.5-100.0)	1455/1588	91.6 (90.2-92.9)		
Nurses	146/146	100.0 (97.5-100.0)	-	-	1502/1683	89.2 (87.7-90.7)
Other medical staff	126/142	88.7 (82.3-93.4)	-	-	-	-
<b>Types of CME activities</b>						
Clinical guideline discussion	141/145	97.2 (93.1-99.2)	1263/1449	87.2 (85.3-90.7)	894/1395	64.1 (61.5-66.6)
Management updates	123/145	84.8 (77.9-90.2)	1116/1384	80.6 (78.5-82.7)	872/1389	62.8 (60.2-65.3)
Case discussions	117/139	84.2 (77.0-93.0)	1084/1371	79.1 (76.8-81.2)	768/1341	57.3 (54.6-59.9)

**Table 3.** CME participation for different types of health professionals according to the three administrative districts (as reported by CHC staff, n=3,580)

	CENTRAL		WESTERN & PERIPHERIAL		EASTERN		$\chi^2$	<i>p</i> -value
	n/N	% (95%CI)	n/N	% (95%CI)	n/N	% (95%CI)		
<b>Health professionals</b>	701/786	89.2 (86.8-91.3)	916/1018	90.0 (88.0-91.8)	1519/1655	91.8 (90.4-93.1)	5.04	0.08
Doctors	370/407	90.9 (87.7-93.5)	424/462	91.8 (88.9-94.1)	751/807	93.1 (91.1-94.7)	1.89	0.39
Nurse	331/379	87.3 (83.6-90.5)	492/556	88.5 (85.5-91.0)	768/848	90.6 (88.4-92.4)	3.31	0.19
<b>Job titles</b>								
Intermediate & Senior	270/282	95.7 (92.7-97.8)	280/290	96.9 (93.8-98.3)	764/786	97.2 (95.8-98.2)	1.46	0.48
Junior	399/456	87.5 (84.1-90.4)	525/569	92.3 (89.8-94.3)	681/763	89.3 (86.8-91.4)	6.64	0.036
<b>Education level</b>								
Bachelor & higher	380/442	86.0 (82.4-89.1)	646/731	88.4 (85.8-90.6)	739/829	89.1 (86.8-91.2)	2.83	0.24
Associate degree and below	316/339	93.2 (90.0-95.7)	265/282	94.0 (90.5-96.4)	770/814	94.6 (92.8-96.0)	0.85	0.66
<b>Registered specialty</b>								
GPs	146/151	96.7 (92.3-98.9)	143/143	100 (97.5-100)	464/487	95.0 (93.0-97.0)	5.73	0.057
Specialists	217/246	88.2 (83.5-92.0)	272/308	88.3 (84.2-91.7)	281/316	88.9 (84.9-91.2)	0.087	0.96

**Table 4** Crude and adjusted odds ratios for participation in CME by health professionals

Participation in CME for doctors (n=1587)	Crude OR (95% CI)	p value	Adjusted OR* (95% CI)	p value
Age	1.08 (1.06-1.11)	<0.01	1.04 (1.02-1.07)	<0.01
Female	1.86 (1.24-2.79)	<0.01	1.72 (1.12-2.63)	0.01
Graduate degree or above	1.45 (1.02-2.08)	0.04	-	-
GP specialty	4.24 (2.69-6.67)	<0.01	2.97 (1.83-4.81)	<0.01
Years working in occupation	1.07 (1.04-1.09)	<0.01	-	-
Senior or intermediate job title (junior title as reference)	4.22 (2.74-6.48)	<0.01	2.16 (1.31-3.56)	<0.01
Participation in CME for nurses (n=1683)				
Age	1.09 (1.06-1.11)	<0.01	-	
Graduate degree or above	3.29 (2.10-5.16)	<0.01	2.85 (1.79-4.55)	<0.01
Years working in occupation	1.10 (1.07-1.13)	<0.01	1.08 (1.05-1.11)	<0.01
Senior or intermediate job title (junior title as reference)	1.59 (1.06-2.11)	<0.01	2.16 (1.17-4.00)	0.01

\* Adjusted for age, gender, medical specialty, years working in the CHC, job title and education level

CI = confidence interval, OR = odds ratio

**Figure 1** Geographical distribution of the selected cities participated in the survey

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Geographical distribution of the selected cities participated in the survey

120x90mm (220 x 220 DPI)

ew only

## Appendix 1

The factors considered for an association with CME participation were:

- Age (continuous variable)
- Gender (Male, Female)
- Ethnicity (Han, Minority, Other)
- Highest Qualification (Lower than associate degree, associate degree, graduate degree with postgraduate qualifications)
- Registered specialty (Integrative medicine, General practice, Other specialty, Nurse, None)
- Current field of work (Integrative Medicine, General, Other specialty, Nurse, None)
- Years of practice in current field of work (continuous variable)
- Title of technical post (Senior, Intermediate, Junior, None)
- Hours spent on patient care (continuous variable)
- Patients in CHC in the last month (Intravenous drug user, female sex worker, male sex worker, men who have sex with men, transgender people)
- Training in HIV prevention, counselling, diagnosis and care (yes/no)
- Training in common STI prevention counselling, diagnosis and care (yes/no)
- Attitudes towards HIV/STI testing in key populations (strongly disagree/disagree, neither agree or disagree/agree/strongly agree/don't know)
  - I think routine STI testing is an important part of regular healthcare
  - I am concerned about cost and reimbursement for STI testing
  - I am concerned that patients will be offended by being offered routine STI testing
  - I am comfortable discussing routine STI testing with patients
  - Language barriers prevent some patients from receiving routine STI testing
  - Patients often feel like they have to accept routine STI testing
  - Patients receive adequate post-test information for routine STI testing
  - Routine STI testing is voluntary; patients are able to decline screening
  - Patients do not expect to be offered routine STI testing
  - I am concerned that routine STI testing will have a negative effect on patients' opinions about our clinic
  - We have the resources needed to implement STI testing
  - It is difficult to provide the privacy needed for routine STI testing
  - I think routine HIV testing is an important part of regular healthcare
  - I am concerned about cost and reimbursement for HIV testing
  - I am concerned that patients will be offended by being offered routine HIV testing
  - I am comfortable discussing routine HIV testing with patients
  - Language barriers prevent some patients from receiving routine HIV testing
  - Patients often feel like they have to accept routine HIV testing
  - Patients receive adequate pre-test information for routine HIV testing
  - Patients receive adequate post-test information for routine HIV testing
  - Routine HIV testing is voluntary; patients are able to decline screening
  - Patients do not expect to be offered routine HIV testing
  - I am concerned that routine HIV testing will have a negative effect on patients' opinions about our clinic



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- We have the resources needed to implement HIV testing
- It is difficult to provide the privacy needed for routine HIV testing
- I can ask the sexual orientation of the patients
- I can obtain a sexual and reproductive health history from the patients

For peer review only

## Reporting checklist

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# BMJ Open

## Primary Care Workforce and Continuous Medical Education in China: Lessons to learn from a Nationwide Survey

Journal:	<i>BMJ Open</i>
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<b>Primary Subject Heading</b>:	General practice / Family practice
Secondary Subject Heading:	Medical education and training
Keywords:	continuing medical education, PRIMARY CARE, Quality of care, Training, China

SCHOLARONE™  
Manuscripts

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4 1 **Primary Care Workforce and Continuous Medical**  
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6 2 **Education in China: Lessons to learn from a Nationwide**  
7  
8 3 **Survey**  
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10  
11 4 **Short title:** Workforce and continuous medical education in primary care in China  
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5 36 **Abstract**

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7 37 **Objectives**

8  
9 38 This study aimed to examine the education and training background of Chinese  
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11 39 community health centres (CHC) staff, continuous medical education (CME) and  
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13 40 factors affecting participation in CME.

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15 41 **Design**

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17 42 Cross-sectional survey

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19 43 **Setting**

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21 44 Community health centres (CHCs)

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23 45 **Participants**

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25 46 All doctors and nurses working in selected CHCs (excluding those solely practising  
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27 47 traditional Chinese Medicine)

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29 48 **Main Outcome Measures**

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31 49 CME recorded by CHCs and self-reported CME participation

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33 50 **Methods**

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35 51 A stratified random sample of CHCs based on geographical distribution and 2:1  
36  
37 52 urban-suburban ratio was selected covering three major regions of China. Two  
38  
39 53 questionnaires, one for lead clinicians and another for frontline health professionals,  
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41 54 were administered between September-December 2015, covering the demographics of  
42  
43 55 clinic staff, staff training and CME activities.

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45 56 **Results**

46  
47 57 149 lead clinicians (response rate 79%) and, 1,734 doctors and 1,846 nurses  
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49 58 completed the survey (response rate 86%). 54.5% of the doctors had a bachelor  
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51 59 degree and only 47% were registered as general practitioners (GPs). 10.5% of doctors  
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53 60 carried senior titles. Few nurses (4.6%) had training in primary care. 91.6% of doctors  
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55 61 and 89.2% of nurses reported participating in CME. CME participation in doctors was  
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57 62 more commonly reported by older doctors, females, those who were registered as a

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3 63 GP and those with intermediate or senior job titles. CME participation in nurses was  
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5 64 commoner among those with a bachelor degree or intermediate/senior job titles, or  
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7 65 those with longer working experience in the CHC.  
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10 66 **Conclusion**

11 67 Only half of doctors have bachelor degrees or are registered as GPs as their prime  
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13 68 registration in the primary care workforce in China. The vast majority of CHC staff  
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15 69 participated in CME but there is room for improvement in how CME is organised.  
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20 71 **Key words** Continuous medical education, Training, Quality of care, Primary care,  
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22 72 China  
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26 74 **Strengths and limitations**

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28 75 This study surveyed the CME situation of a random sample of 3,580 medical staff in  
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30 76 CHCs in mainland China. We focused on doctors and nurses working in CHCs, who  
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32 77 are the core of the primary care workforce. Our study provides a useful baseline of the  
33  
34 78 frequency and types of locally-organised CME activities across a large number of  
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36 79 CHCs. The main limitation of this study is that we focused on CME activities that  
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38 80 were organised by CHCs but arguably those were the most commonly attended by the  
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40 81 staff of individual CHCs. It would be valuable to also know how frequently staff  
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42 82 participated in CMEs conducted outside of organizations (e.g. by training institutions  
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44 83 or self-directed learning). We did not evaluate the quality of CME being delivered  
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46 84 nor whether observable health improvements had resulted from CME participation.  
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48 85 Other important parameters for CME evaluation to consider would be costs to attend  
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50 86 CME, management support, funding/resources, quality of CME instructors/coaches.  
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52 87 Although we surveyed over 3,500 medical staff from a random sample of CHCs in  
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54 88 China, they may not be representative of all CHC staff in China. Moreover, social  
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56 89 desirability might constitute a threat in such self-reported surveys especially if  
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58 90 participation in the survey was encouraged by the supervisors. These could be the

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3 91 subject of future research through in-depth qualitative interviews of CHC staff and  
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5 92 focused evaluations of CME programs in China.  
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## 15 **Introduction**

16 The importance of a strong primary care system based on first contact access and  
17 provision of person-focused comprehensive care with continuity and coordination, is  
18 widely accepted.<sup>1-6</sup> Despite a strong primary care system being repeatedly shown to  
19 be an effective approach at reducing health inequity and achieving universal health  
20 coverage,<sup>2</sup> many countries have yet to develop a robust primary healthcare system.  
21 Instead, primary care services are often characterized by inadequate resources and  
22 facilities, lack of appropriate training for their medical staff, variable quality in  
23 delivery of care and fragmented care.<sup>7</sup> In China, these problems were further  
24 compounded by economic and healthcare reforms in the 1980s which involved fiscal  
25 decentralization, commercialization of medical services, and underfunding of the  
26 public healthcare sector. These turned a generation of health professionals and the  
27 general public to rely heavily on high-tech diagnostics, expensive drugs and specialist  
28 procedures.<sup>8,9</sup> These factors reinforced unrealistic patient expectations focused on  
29 specialist diagnostic aids and procedures, while alienating cost-efficient primary care  
30 that would better suit the nation's health needs.<sup>10</sup>  
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47 In 2009, the Chinese government responded to these problems and committed  
48 themselves to re-establishing primary healthcare.<sup>11</sup> According to Health & Family  
49 Planning Commission, expenditure on primary care has reached USD17.74 billion  
50 (1USD=¥6.20) and accounted for approximately 30% of the public spending on  
51 health in 2014.<sup>12</sup> In fewer than ten years, the Chinese Government has succeeded in  
52 establishing a primary care infrastructure composed mainly of rural township centres,  
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3 118 village clinics and community health centres (CHCs) in cities. By 2014, 8,669 CHCs  
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5 119 were established, employing over 300,000 health professionals, the great majority of  
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7 120 which were from the established rural practices. However, the historical image of  
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9 121 ‘barefoot doctors’ who had worked in rural regions since the 1950s, criticism of the  
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11 122 healthcare system by end-users, and negative publicity by the media have all led to a  
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13 123 breakdown of trust between patients and health professionals, including in the newly-  
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15 124 revamped primary care system.<sup>9</sup> This problem appears particularly pronounced in the  
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17 125 cities where patients have greater choice and easier access to hospitals. One of the  
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19 126 major problem is that CHC health professionals (doctors and nurses included) are  
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21 127 regarded as poorly qualified and trained, and CHCs are poorly resourced, providing  
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23 128 “low tech” facilities.<sup>13</sup>

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28 130 In the past, medical courses were offered by a variety of colleges, vocational training  
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30 131 schools and universities, ranging from 2-8 years of training. Graduates of these  
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32 132 courses would have to sit and pass board examinations to be registered for their  
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34 133 chosen specialties. Although shorter courses are still available to train the rural  
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36 134 workforce, five-year undergraduate programs based at the university are now the  
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38 135 norm to enter into vocational training. Nonetheless, general practice is a relatively  
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40 136 new clinical discipline in China and there are currently few general practice  
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42 137 departments in medical schools.<sup>14</sup> Hence, the exposure to general practice and primary  
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44 138 care teaching at the undergraduate level is minimal and the discipline has a low status  
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46 139 amongst other clinical disciplines.

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50 141 At the vocational training level, the emphasis has been on implementing the new  
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52 142 policy of establishing primary care in a very short time span through re-orientation of  
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54 143 specialists to general practice, initially by “on-the-job training” and later replaced by  
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56 144 “job-transfer” training. “Job-transfer training” is a one-year long programme aimed at



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3 145 the less qualified doctors currently working at CHCs or those who have not  
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5 146 undergone “on-the-job training” which entailed a series of short courses to enhance  
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7 147 their theoretical knowledge of general practice and practical clinical skills through a  
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9 148 combination of lectures, hospital rotations and community-based placements. Since  
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11 149 2011 this has been replaced by a three-year structured program with 2.5 years in  
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13 150 hospital rotations followed by six months in the community.

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18 152 Continuous medical education (CME) aimed at maintaining, developing and  
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20 153 enhancing medical providers’ professional knowledge, skills and interpersonal  
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22 154 capacity to keep abreast of professional lives, is an essential element to maintain  
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24 155 quality of care in this new system<sup>15,16</sup> and CME is compulsory for ongoing  
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26 156 registration in China. These CHC staff are required to participate in CME organised  
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28 157 by training institutions at national, provincial, municipal, district and center level, and  
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30 158 they have to fulfil at least 25 credits of approved CME every year which is accredited  
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32 159 every two years. According to the “Twelfth 5-year plan”,<sup>17</sup> 100% of senior, 95% of  
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34 160 mid-grade; and 80% of junior health professionals at provincial and city levels should  
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36 161 achieve the required CME targets over two years. For staff working in western and  
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38 162 peripheral regions of China, these targets were reduced to 95%, 80% and 70%  
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40 163 respectively to reflect the phased development of primary care in these large and  
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42 164 dispersed regions of the country. The hierarchy of the titles can only be achieved after  
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44 165 passing the qualifying examination and fulfilling a number of stringent criteria  
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46 166 including CME requirements, written examinations and publication of research  
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48 167 manuscripts. This study aimed to evaluate the current organization and manpower of  
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50 168 CHCs in China, as well as the training (especially the content and delivery of CME)  
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52 169 of health professionals within primary care in China.

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55 171 **Methods**

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3 172 A nationwide survey using a stratified randomized sample was conducted amongst  
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5 173 CHC medical professionals between September and December 2015. China was  
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7 174 divided into three administrative regions: central, eastern and western. These regional  
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9 175 differentiation are based on geographic, economical and medical jurisdiction. Two  
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11 176 provinces were randomly selected from each region; and from these, the capital city  
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13 177 and two district-level cities were selected at random. In addition, two of the four  
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15 178 major municipalities (Beijing, Shanghai, Chongqing and Tianjin) were also selected at  
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17 179 random and included in the sample. In total, twenty cities were chosen from the  
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19 180 provinces and municipalities combined. From these, nine CHCs were randomly  
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21 181 selected from each city (with an urban-to-suburban ratio of 2:1), giving a total of 180  
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23 182 CHCs. The lead clinicians and all doctors and nurses (excluding traditional Chinese  
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25 183 herbalists) with direct patient contact from these selected CHCs were invited to  
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27 184 participate in the survey.

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31 186 The local chairpersons of the General Practitioner Associations of the six selected  
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33 187 provinces and two selected municipalities were contacted, whom in turn, contacted  
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35 188 the randomly selected CHCs. Training on how to distribute and complete the survey  
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37 189 questionnaire was arranged for the coordinators of each province or municipality prior  
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39 190 to the study. These coordinators were responsible for tracking and collecting the  
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41 191 questionnaires. Collected data was entered and cleaned using EPIDATA 3.1. A data  
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43 192 entry team was responsible for data input and appointed personnel for auditing and  
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45 193 quality control.

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49 195 The study consisted of two questionnaires, one for the lead clinicians and another for  
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51 196 CHC staff (i.e. doctors and nurses). The former (Appendix 1) covered current clinical  
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53 197 set-up, range of services and staff composition, community characteristics and patient  
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55 198 demographics; as well as information on CME organized at the clinic. In this survey  
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57 199 we asked the lead clinician to use their own records to estimate the median population

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3 200 size of the catchment area and number of patient contacts in the past year. In the  
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5 201 second survey, we asked the frontline health professionals about their training  
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7 202 experience, CME participation and their willingness to conduct certain testing  
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9 203 services. CME organized by CHCs was compared with actual participation reported  
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11 204 by the CHC staff. These surveys were pilot-tested twice on three CHCs and twenty-  
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13 205 five practitioners with modifications made accordingly. Detailed methodology and,  
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15 206 availability and use of primary care facilities is reported elsewhere.<sup>18</sup>  
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19 208 Descriptive analyses were conducted for percentages and frequencies of key  
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21 209 parameters. These were compared with the National Health Statistics Yearbook<sup>12</sup>.  
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23 210 Confidence intervals for the sample proportions were calculated using the Agresti-  
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25 211 Coull (adjusted Wald) method. CME content were defined as 'clinical guidelines  
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27 212 discussion' (i.e. discussion of new clinical guidelines i.e. proecdures in diagnosis or  
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29 213 new drugs in managing a patient with a selected condition common to primary care),  
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31 214 'mangement updates' (i.e. new drugs or procedures that becomes available to the  
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33 215 CHC or changes in workflow at the practice), and 'case discussion' (i.e. presentation  
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35 216 of a difficult case for group input with supporting evidence form the literature). CME  
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37 217 participation and content were broken down according to the three administrative  
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39 218 districts which have different requirements for CME participation. Univariate logistic  
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41 219 regression was used to explore the staff characteristics as the independent factors  
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43 220 (with crude odds ratios (OR) and 95% confidence intervals (CI) calculated) associated  
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45 221 with participation of CME by the health professionals after adjusting for gender,  
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47 222 medical specialty, years working in the CHC, job title and education level. We also  
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49 223 examined factors related to the clinical set up, range of services offered, staff  
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51 224 composition, community characteristics and patient demographics (see Appendix 1  
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53 225 for full list of variables from questionnaire) and present in the paper factors which  
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55 226 were statistically significant. All variables with p values <0.10 was included in the  
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57 227 multivariate model and through backward elimination, we report the final variables  
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3 228 (with adjusted odds ratios (AOR)) with a p-value less than 0.05 as statistically  
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5 229 significant by convention. We adjusted the final model for age, gender, medical  
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7 230 specialty, years working in the CHC, job title and education level. Data were  
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9 231 analyzed using STATA (StataCorp. 2013. *Stata Statistical Software: Release 13*.  
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11 232 College Station, TX: StataCorp LP).

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## 15 234 **Results**

16  
17 235 One hundred and forty-nine out of the 189 CHCs contacted provided data on their  
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19 236 CHC (79% response rate). Figure 1 shows the distribution of CHCs surveyed in China.  
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21 237 The median number of fulltime general practitioners working at CHC was 8  
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23 238 (interquartile range (IQR) 4-14) and fulltime nurses was 13 (IQR 8-12). Of the 4,146  
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25 239 health professionals invited, 1,734 doctors and 1,846 nurses completed the survey  
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27 240 giving a response rate of 86%. A very small percentage of them might have double  
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29 241 qualifications in medicine and nursing.

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34 243 The median population size of the catchment area of each CHC was 50,000 people  
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36 244 (IQR 30,000 to 96,000) with a migrant population of 11,100 (IQR 5,000-30,000). The  
37  
38 245 median patient contacts per year was 41,100 (IQR 12,000 to 163,600). Table 1  
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40 246 provides the demographics of CHC staff compared with the 2015 National Health  
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42 247 Statistics Yearbook.<sup>12</sup> The median age of CHC doctors and nurses were young at 38  
43  
44 248 and 31 years of age, respectively, with a nurse-to-doctor ratio of 1.6. Women  
45  
46 249 accounted for 61% of the doctors and nearly all the nurses. About half (54.5%) of the  
47  
48 250 doctors had bachelor degrees or above, yet only 10.5% of them had acquired senior  
49  
50 251 titles. Despite the fact that all were practising as general practitioners (GPs), only 47%  
51  
52 252 were actually registered as one. Doctors and nurses had worked for a median of 14  
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54 253 years and 9 years, respectively.

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3 255 Table 2 shows the range and frequency of reported on-site CME and CME  
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5 256 participation at each CHC. CME activities were held by nearly all CHCs (97.2%),  
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7 257 where about two-thirds (67.1%) conducted CME sessions monthly or more frequently.  
8  
9 258 The type of in-house CME activities reported were clinical guidelines discussion  
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11 259 (100%), management updates (87.9%) and case discussions (83.6%).  
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16 261 Table 3 shows CME participation for different types of health professionals in the  
17  
18 262 three administrative districts. Despite CME participation being extremely high  
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20 263 (ranging between 86% to 100% ), those in the central and eastern regions fell short of  
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22 264 the targets set by the State. In contrast to what was expected by the government, there  
23  
24 265 was no significant difference of CME participation by GPs in the three administrative  
25  
26 266 regions and CME participation was actually commoner among junior doctors in the  
27  
28 267 western and peripheral regions compared to the central and eastern regions (p=0.036).  
29

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32 269 Table 4 summarizes the multivariate analysis of health professionals' characteristics  
33  
34 270 with CME participation. Amongst doctors, CME participation was commoner among  
35  
36 271 older doctors (adjusted odds ratios (aOR) 1.04 per year), women (aOR 1.7), those  
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38 272 registered as GPs (aOR 3.0) and those with an intermediate or senior job title (aOR  
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40 273 2.2). Amongst nurses, CME participation was commoner among those with bachelor  
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42 274 degrees (aOR 2.9), with longer experience working in general practice (aOR 1.1 per  
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44 275 year) or with an intermediate or senior job title (aOR 2.2).  
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## 48 277 **Discussion**

49 278 This large study of China's CHCs examines the current primary care workforce and  
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51 279 finds it is predominantly staffed by young female health professionals, with only half  
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53 280 of doctors holding a bachelor degree or higher, or registered as a GP. The relatively  
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55 281 low nurse-to-doctor ratio may reflect the focus of care on doctor-centred approach in  
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3 282 the traditional medical model. Indeed the lead physicians reported on average there  
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5 283 were 1-2 pharmacists, physiotherapists, laboratory technicians or radiographers but  
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7 284 clinical psychologists or medical social workers were uncommon. The ratio was far  
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9 285 from the international standard of approximately three nurses per doctors as  
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11 286 recommended by World Health Organization (WHO).<sup>19</sup> Evidence exists that an  
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13 287 undersupply of nurses could result in inefficient allocation of resources.<sup>20</sup>

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18 289 For historical reasons, many practicing health professionals at CHCs do not have a  
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20 290 bachelor degree.<sup>14</sup> Indeed, our study shows just over half of the doctors and under a  
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22 291 third of the nurses working in primary care have a bachelor degree. This may  
23  
24 292 contribute in part to the perception of poor training and poor quality in primary care.  
25  
26 293 The quality of health care should be based upon the quality of the workforce rather  
27  
28 294 than just increasing the sheer quantity of staff as it has been the focus of China's  
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30 295 policy on development of primary care thus far. The education level and title seniority  
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32 296 through examination are considered important indicators of professional standards and  
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34 297 competency. Nurses who have a higher level of education provide better health care  
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36 298 and safety for their patients.<sup>21</sup>

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41 300 In China, due to the short history of primary care development, many senior doctors  
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43 301 were previously either public health physicians or specialist who converted to being  
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45 302 GPs and were given the task of setting up CHCs. Previously "on-the-job" and now  
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47 303 "job-transfer" training is offered to the specialists who have converted to work as GPs  
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49 304 before sitting the qualifying examination. In order to attract them to primary care,  
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51 305 they are allowed to keep up to three specialties on their registration but in our survey,  
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53 306 only 47% of the doctors chose to register general practice as their prime registration.  
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55 307 We confirm that the CME participation rates for those registered as GPs are higher  
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57 308 than those still registered as a specialist. Further, 97% of staff members with

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3 309 intermediate and senior level job titles participated in CME, which accounted for 39%  
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5 310 of all CHC health professionals (52% of GPs and 29% of nurses). An advancement in  
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7 311 job titles may provide a sense of ownership and autonomy,<sup>9</sup> and thus was identified as  
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9 312 an independent factor in the participation of CME in our study.

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14 314 CME is a requirement for practicing professionals in many countries including China  
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16 315 in order to maintain medical knowledge and skills.<sup>22</sup> Doctors who do not participate in  
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18 316 CME have lower confidence when making clinical decisions.<sup>21</sup> Although it is  
19  
20 317 encouraging to see nearly all CHC staff had participated in CME, one-third of CHCs  
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22 318 organize on-site CME activities once every quarter or even once a year, which is far  
23  
24 319 from satisfactory. A Cochrane review suggests that CME should be accessible within  
25  
26 320 health professionals' own clinical communities.<sup>23</sup> Other forms of CME might include  
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28 321 attending professional conferences, research workshops or distance learning courses  
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30 322 so long as they have been approved by the postgraduate center in their respective city  
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32 323 but the focus of CME undergone by doctors or nurses could be different and there are  
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34 324 no fixed rules as how frequent they should attend these activities. Learning objectives  
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36 325 must be tailored beyond meeting the staff's CME requirements where each CHC or  
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38 326 jointly in a locality should take into account the local context and needs e.g. the local  
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40 327 disease pattern and epidemiology, and to provide the necessary training and support to  
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42 328 their staff to address the skill-mix to deliver the service.

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46 330 Arguably, reflective learning, meeting self-defined learning objectives and auditing  
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48 331 clinical performance with practitioners expected to demonstrate certain competencies  
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50 332 in managing the patients independently, would be more appropriate in quality  
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52 333 improvement rather than time-based training.<sup>21</sup> Lack of time and appropriate  
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54 334 resources have been reported as obstacles for CME participation in China.<sup>24</sup>  
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56 335 Alternatives such as self-directed searches in the medical literature or medical  
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58 336 websites, or structured resources on the internet (e.g. BMJ learning) or medical



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3 337 journals, exist to meet their learning needs.<sup>25,26</sup> Nonetheless these alternatives are  
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5 338 limited by the motivation and skills required to perform these searches effectively as  
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7 339 well as the availability and accessibility (including the language barrier) of these  
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9 340 resources.

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13 342 Our study suggests that 97.2% of CHCs hold discussions and learning sessions about  
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15 343 treatment protocols and 84.8% on disease updates. If used well, evidence-based  
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17 344 medicine can aid health professionals in making the most appropriate therapeutic  
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19 345 decisions for individual patients and conditions at the clinical level. However, rapid  
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21 346 advancements in therapeutic methods and multiple guidelines from both local and  
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23 347 international agencies have made it difficult for health professionals to follow them  
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25 348 closely. Primary healthcare staff can learn and incorporate these new updates and  
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27 349 guidelines into their clinical practices only when they engage in the dissemination and  
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29 350 implementation at the early stage, and have the support of their senior colleagues.  
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31 351 Moreover, GPs need to take the opportunities provided by CME to share difficulties  
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33 352 when dealing with individual patients and build the team to cope with different  
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35 353 professional environments.<sup>27</sup> Significant event audit is a regular and compulsory part  
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37 354 of annual appraisal for all doctors in the NHS in the UK.<sup>28</sup>

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41 356 Our survey found that the current CME participation fell short of the overall 95%  
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43 357 standard from the “Twelfth Five Years Plan”,<sup>17</sup> where 92% of doctors and 89% of  
44  
45 358 nurses surveyed reported regular CME participation. Contrary to what was believed  
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47 359 by the policymakers (as reflected in the targets set), participation rates for doctors  
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49 360 from the Western and peripheral region CME not only exceeded the target, but  
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51 361 evidently Western and peripheral region doctors of junior title had participated more  
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53 362 than their counterparts in the other regions, which suggests such regional  
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55 363 differentiation is unnecessary.



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6 **365 Conclusion**

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8 366 In this study, it shows the high participation rates of CME amongst health  
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10 367 professionals in CHCs, if used well, could maintain high standards of practice  
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12 368 amongst the primary care workforce in China. CHCs could focus on improving  
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14 369 nurses-to-doctor, bachelors-to-non-graduate and title seniority ratios as quality  
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16 370 workforce improvements. There are disadvantages to continue to rely on conversion  
17  
18 371 of specialists as a source of primary care workforce. At the same time, CME  
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20 372 programmes should be decentralised and take on various forms to meet the local and  
21  
22 373 individual needs whilst regional CME differentiation is unnecessary.  
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28 **376 Conflict of Interest**

29  
30 377 The authors declare that they have no competing interests to declare.  
31

32 378

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34 **379 Ethical Considerations**

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36 380 Ethics Committee approvals from a local board (HKU/HAW IRB: UW15-350) and  
37  
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27  
28 403 the survey.  
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#### 32 405 **Contributorship Statement**

33  
34  
35 406 William CW Wong designed the study and the questionnaire, and wrote up the report.  
36  
37 407 ShanZhu Zhu led the team and oversaw the implementation, and liaised with different  
38  
39 408 Chinese GP Associations. Jason Ong conducted the data analysis, and drafted the  
40  
41 409 results of the manuscript with William CW Wong. MingHui Peng implemented the  
42  
43 410 study and helped some of the data analysis. Cindy L. K. Lam, Michael R Kidd and  
44  
45 411 Martin Roland advised on the study design and questionnaire, and commented on the  
46  
47 412 reports. SunFang Jiang led the team and oversaw the implementation, led the pilot  
48  
49 413 testing as well as implementation of the study, took part in the discussion and  
50  
51 414 modification of the design and the questionnaire.  
52

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483 **Table 1.** Basic characteristics and training of CHC health professionals,  
 484 compared with the 2015 National Health Statistics Yearbook<sup>12</sup>

Variables	DOCTORS		2015 Yearbook	NURSES		2015 Yearbook
	n/N	% (95% CI)		n/N	% (95% CI)	
Median Age (IQR)		38 (32-46)	-		31 (26-39)	-
<b>Gender</b>						
Female	1,025/ 1675	61.2 (58.8-63.5)	53.2	1,793/ 1803	99.4 (99.0-99.7)	99.4
<b>Education</b>						
Below associate degree	202/ 1724	11.7 (10.2-13.3)	19.1	382/ 1831	20.9 (19.0-22.8)	44.4
Associate degree*	582/ 1724	33.8 (31.5-36.0)	36.9	920/ 1831	50.2 (47.9-52.6)	48.3
Bachelor degree or higher	940/ 1724	54.5 (52.1-56.9)	44.0	529/ 1831	28.9 (26.8-31.0)	10.3
<b>Job title</b>						
Senior	180/ 1711	10.5 (9.1-12.1)	10.5	46/ 1815	2.5 (1.9-3.4)	1.5
Intermediate	705/ 1711	41.2 (38.9-43.6)	41.3	471/ 1815	26.0 (23.9-28.0)	22.2
Junior	683/ 1711	39.9 (37.6-42.3)	41.9	1,158/ 1815	63.8 (61.5-66.0)	66.9
None	143/ 1711	8.4 (7.1-9.8)	6.2	140/ 1815	7.7 (6.5-9.0)	9.4
<b>Registered Speciality</b>						
Integrative Medicine	145/ 1700	8.5 (7.2-10.0)	-	2/ 1834	0.1 (0.0-0.4)	-
General practice	799/ 1700	47.0 (44.6-49.4)	-	85/ 1834	4.6 (3.7-5.7)	-
Other Specialty	454/ 1700	26.7 (24.6-28.9)	-	19/ 1834	1.0 (0.6-1.6)	-
Nurse	23/ 1700	1.4 (0.9-2.0)	-	1712/ 1834	93.3 (92.1-94.4)	-
None	75/ 1700	4.4 (3.5-5.5)	-	30/ 1834	1.6 (1.1-2.3)	-
Other	295/ 1700	17.4 (15.6-19.2)	-	18/ 1834	1.0 (0.6-1.5)	-
<b>Median Years working in above speciality (IQR)</b>	14 (7-23)		-	9 (4-18)		-

485 \* Associate degree refers to 2-years health related sub-degree equivalent to a physician assistant

486 CI=Confidence interval, IQR = interquartile range

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488 **Table 2.** Continuous medical education organised and undertaken by the CHCs.

	n/N	% (95%CI)
CHC offering Continuous Medical Education	140/144	97.2 (93.0-99.2)
<b>Frequency of CME organised at CHCs</b>		
Yearly	16/140	11.4 (7.1-17.9)
Quarterly	25/140	17.9 (12.3-25.1)
Bimonthly	13/140	9.3 (5.4-15.4)
Monthly	77/140	55.0 (46.7-63.0)
Biweekly	15/140	10.7 (6.5-17.0)
Weekly	2/140	1.4 (0.1-5.4)
<b>Staff participating in CME</b>		
Managers	140/140	100 (96.8-100)
Doctors	140/140	100.0 (96.8-100.0)
Nurses	140/140	100.0 (96.8-100.0)
Other medical staff	126/140	90.0 (83.8-94.1)
<b>Types of CME activities</b>		
Clinical guideline discussion	140/140	100 (96.8-100)
Management updates	123/140	87.9 (81.3-92.4)
Case discussions	117/140	83.6 (76.5-88.9)

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493 **Table 3.** CME participation for different types of health professionals according to  
 494 the three administrative districts (as reported by CHC staff, n=3,580)

	CENTRAL		WESTERN & PERIPHERIAL		EASTERN		$\chi^2$	<i>p</i> -value
	n/N	% (95% CI)	n/N	% (95% CI)	n/N	% (95% CI)		
<b>Health professionals</b>	701/786	89.2 (86.8-91.3)	916/1018	90.0 (88.0-91.8)	1519/1655	91.8 (90.4-93.1)	5.04	0.08
Doctors	370/407	90.9 (87.7-93.5)	424/462	91.8 (88.9-94.1)	751/807	93.1 (91.1-94.7)	1.89	0.39
Nurse	331/379	87.3 (83.6-90.5)	492/556	88.5 (85.5-91.0)	768/848	90.6 (88.4-92.4)	3.31	0.19
<b>Job titles</b>								
Intermediate & Senior	270/282	95.7 (92.7-97.8)	280/290	96.9 (93.8-98.3)	764/786	97.2 (95.8-98.2)	1.46	0.48
Junior	399/456	87.5 (84.1-90.4)	525/569	92.3 (89.8-94.3)	681/763	89.3 (86.8-91.4)	6.64	0.036
<b>Education level</b>								
Bachelor & higher	380/442	86.0 (82.4-89.1)	646/731	88.4 (85.8-90.6)	739/829	89.1 (86.8-91.2)	2.83	0.24
Associate degree and below	316/339	93.2 (90.0-95.7)	265/282	94.0 (90.5-96.4)	770/814	94.6 (92.8-96.0)	0.85	0.66
<b>Registered specialty</b>								
GPs	146/151	96.7 (92.3-98.9)	143/143	100 (97.5-100)	464/487	95.0 (93.0-97.0)	5.73	0.057
Specialists	217/246	88.2 (83.5-92.0)	272/308	88.3 (84.2-91.7)	281/316	88.9 (84.9-91.2)	0.087	0.96

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507 **Table 4** Crude and adjusted odds ratios for participation in CME by health  
 508 professionals

Participation in CME for doctors (n=1587)	Crude OR (95% CI)	p value	Adjusted OR* (95% CI)	p value
Age	1.08 (1.06-1.11)	<0.01	1.04 (1.02-1.07)	<0.01
Female	1.86 (1.24-2.79)	<0.01	1.72 (1.12-2.63)	0.01
Graduate degree or above	1.45 (1.02-2.08)	0.04	-	-
GP specialty	4.24 (2.69-6.67)	<0.01	2.97 (1.83-4.81)	<0.01
Years working in occupation	1.07 (1.04-1.09)	<0.01	-	-
Senior or intermediate job title (junior title as reference)	4.22 (2.74-6.48)	<0.01	2.16 (1.31-3.56)	<0.01
Participation in CME for nurses (n=1683)				
Age	1.09 (1.06-1.11)	<0.01	-	
Graduate degree or above	3.29 (2.10-5.16)	<0.01	2.85 (1.79-4.55)	<0.01
Years working in occupation	1.10 (1.07-1.13)	<0.01	1.08 (1.05-1.11)	<0.01
Senior or intermediate job title (junior title as reference)	1.59 (1.06-2.11)	<0.01	2.16 (1.17-4.00)	0.01

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\* Adjusted for age, gender, medical specialty, years working in the CHC, job title and education level

CI = confidence interval, OR = odds ratio

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527

528 **Figure 1** Geographical distribution of the selected cities participated in the survey

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## Appendix 1

The factors considered for an association with CME participation were:

- Age (continuous variable)
- Gender (Male, Female)
- Ethnicity (Han, Minority, Other)
- Highest Qualification (Lower than associate degree, associate degree, graduate degree with postgraduate qualifications)
- Registered specialty (Integrative medicine, General practice, Other specialty, Nurse, None)
- Current field of work (Integrative Medicine, General, Other specialty, Nurse, None)
- Years of practice in current field of work (continuous variable)
- Title of technical post (Senior, Intermediate, Junior, None)
- Hours spent on patient care (continuous variable)
- Patients in CHC in the last month (Intravenous drug user, female sex worker, male sex worker, men who have sex with men, transgender people)
- Training in HIV prevention, counselling, diagnosis and care (yes/no)
- Training in common STI prevention counselling, diagnosis and care (yes/no)
- Attitudes towards HIV/STI testing in key populations (strongly disagree/disagree, neither agree or disagree/agree/strongly agree/don't know)
  - I think routine STI testing is an important part of regular healthcare
  - I am concerned about cost and reimbursement for STI testing
  - I am concerned that patients will be offended by being offered routine STI testing
  - I am comfortable discussing routine STI testing with patients
  - Language barriers prevent some patients from receiving routine STI testing
  - Patients often feel like they have to accept routine STI testing
  - Patients receive adequate post-test information for routine STI testing
  - Routine STI testing is voluntary; patients are able to decline screening
  - Patients do not expect to be offered routine STI testing
  - I am concerned that routine STI testing will have a negative effect on patients' opinions about our clinic
  - We have the resources needed to implement STI testing
  - It is difficult to provide the privacy needed for routine STI testing
  - I think routine HIV testing is an important part of regular healthcare
  - I am concerned about cost and reimbursement for HIV testing
  - I am concerned that patients will be offended by being offered routine HIV testing
  - I am comfortable discussing routine HIV testing with patients
  - Language barriers prevent some patients from receiving routine HIV testing
  - Patients often feel like they have to accept routine HIV testing
  - Patients receive adequate pre-test information for routine HIV testing
  - Patients receive adequate post-test information for routine HIV testing
  - Routine HIV testing is voluntary; patients are able to decline screening
  - Patients do not expect to be offered routine HIV testing
  - I am concerned that routine HIV testing will have a negative effect on patients' opinions about our clinic

- We have the resources needed to implement HIV testing
- It is difficult to provide the privacy needed for routine HIV testing
- I can ask the sexual orientation of the patients
- I can obtain a sexual and reproductive health history from the patients

For peer review only

## Reporting checklist

Item	Page
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# BMJ Open

## Primary Care Workforce and Continuous Medical Education in China: Lessons to learn from a Nationwide Cross-sectional Survey

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<b>Primary Subject Heading</b>:	General practice / Family practice
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Keywords:	continuing medical education, PRIMARY CARE, Quality of care, Training, China

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Manuscripts

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4 1 **Primary Care Workforce and Continuous Medical**  
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6 2 **Education in China: Lessons to learn from a Nationwide**  
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8 3 **Cross-sectional Survey**  
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10

11 4 **Short title:** Workforce and continuous medical education in primary care in China  
12

13 5  
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3 **35 Abstract**

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5 **36 Objectives**

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7 This study aimed to examine the education and training background of Chinese  
8  
9 community health centres (CHC) staff, continuous medical education (CME) and  
10  
11 factors affecting participation in CME.

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13 **40 Design**

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15 Cross-sectional survey

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17 **42 Setting**

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19 Community health centres (CHCs)

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21 **44 Participants**

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23 All doctors and nurses working in selected CHCs (excluding those solely practising  
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25 traditional Chinese Medicine)

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27 **47 Main Outcome Measures**

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29 CME recorded by CHCs and self-reported CME participation

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31 **49 Methods**

32  
33 A stratified random sample of CHCs based on geographical distribution and 2:1  
34  
35 urban-suburban ratio was selected covering three major regions of China. Two  
36  
37 questionnaires, one for lead clinicians and another for frontline health professionals,  
38  
39 were administered between September-December 2015, covering the demographics of  
40  
41 clinic staff, staff training and CME activities.

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43 **55 Results**

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45 149 lead clinicians (response rate 79%) and, 1,734 doctors and 1,846 nurses  
46  
47 completed the survey (response rate 86%). 54.5% of the doctors had a bachelor  
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49 degree and only 47% were registered as general practitioners (GPs). 10.5% of doctors  
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51 carried senior titles. Few nurses (4.6%) had training in primary care. 91.6% of doctors  
52  
53 and 89.2% of nurses reported participating in CME. CME participation in doctors was  
54  
55 more commonly reported by older doctors, females, those who were registered as a  
56  
57 GP and those with intermediate or senior job titles. CME participation in nurses was

63 commoner among those with a bachelor degree or intermediate/senior job titles, or  
64 those with longer working experience in the CHC.

### 65 **Conclusion**

66 Only half of doctors have bachelor degrees or are registered as GPs as their prime  
67 registration in the primary care workforce in China. The vast majority of CHC staff  
68 participated in CME but there is room for improvement in how CME is organised.

69  
70 **Key words** Continuous medical education, Training, Quality of care, Primary care,  
71 China

### 72 73 **Strengths and limitations**

- 74 - We surveyed the CME situation of a random sample of 3,580 medical staff in  
75 community health centres (CHCs) in mainland China, focusing on doctors and  
76 nurses, who are the core of the primary care workforce.
- 77 - Our study provides a useful baseline of the frequency and types of locally-  
78 organised CME activities across a large number of CHCs.
- 79 - The main limitation of this study was that we focused on CME activities that  
80 were organised by CHCs
- 81 - We did not evaluate the quality of CME being delivered nor whether  
82 observable health improvements had resulted from CME participation.
- 83 - Social desirability may be a source of bias especially if participation in the  
84 survey was encouraged by the supervisors.

### 85 86 **Introduction**

87 The importance of a strong primary care system based on first contact access and  
88 provision of person-focused comprehensive care with continuity and coordination, is  
89 widely accepted.<sup>1-6</sup> Despite a strong primary care system being repeatedly shown to

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4 90 be an effective approach at reducing health inequity and achieving universal health  
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6 91 coverage,<sup>2</sup> many countries have yet to develop a robust primary healthcare system.  
7  
8 92 Instead, primary care services are often characterized by inadequate resources and  
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10 93 facilities, lack of appropriate training for their medical staff, variable quality in  
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12 94 delivery of care and fragmented care.<sup>7</sup> In China, these problems were further  
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14 95 compounded by economic and healthcare reforms in the 1980s which involved fiscal  
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16 96 decentralization, commercialization of medical services, and underfunding of the  
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18 97 public healthcare sector. These turned a generation of health professionals and the  
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20 98 general public to rely heavily on high-tech diagnostics, expensive drugs and specialist  
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22 99 procedures.<sup>8,9</sup> These factors reinforced unrealistic patient expectations focused on  
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24 100 specialist diagnostic aids and procedures, while alienating cost-efficient primary care  
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26 101 that would better suit the nation's health needs.<sup>10</sup>  
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29 103 In 2009, the Chinese government responded to these problems and committed  
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31 104 themselves to re-establishing primary healthcare.<sup>11</sup> According to Health & Family  
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33 105 Planning Commission, expenditure on primary care has reached USD17.74 billion  
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35 106 (1USD=¥6.20) and accounted for approximately 30% of the public spending on  
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37 107 health in 2014.<sup>12</sup> In fewer than ten years, the Chinese Government has succeeded in  
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39 108 establishing a primary care infrastructure composed mainly of rural township centres,  
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41 109 village clinics and community health centres (CHCs) in cities. By 2014, 8,669 CHCs  
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43 110 were established, employing over 300,000 health professionals, the great majority of  
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45 111 which were from the established rural practices. However, the historical image of  
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47 112 'barefoot doctors' who had worked in rural regions since the 1950s, criticism of the  
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49 113 healthcare system by end-users, and negative publicity by the media have all led to a  
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51 114 breakdown of trust between patients and health professionals, including in the newly-  
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53 115 revamped primary care system.<sup>9</sup> This problem appears particularly pronounced in the  
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55 116 cities where patients have greater choice and easier access to hospitals. One of the  
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57 117 major problem is that CHC health professionals (doctors and nurses included) are

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3 118 regarded as poorly qualified and trained, and CHCs are poorly resourced, providing  
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5 119 “low tech” facilities.<sup>13</sup>  
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11 121 In the past, medical courses were offered by a variety of colleges, vocational training  
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13 122 schools and universities, ranging from 2-8 years of training. Graduates of these  
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15 123 courses would have to sit and pass board examinations to be registered for their  
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17 124 chosen specialties. Although shorter courses are still available to train the rural  
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19 125 workforce, five-year undergraduate programs based at the university are now the  
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21 126 norm to enter into vocational training. Nonetheless, general practice is a relatively  
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23 127 new clinical discipline in China and there are currently few general practice  
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25 128 departments in medical schools.<sup>14</sup> Hence, the exposure to general practice and primary  
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27 129 care teaching at the undergraduate level is minimal and the discipline has a low status  
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29 130 amongst other clinical disciplines.  
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33 132 At the vocational training level, the emphasis has been on implementing the new  
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35 133 policy of establishing primary care in a very short time span through re-orientation of  
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37 134 specialists to general practice, initially by “on-the-job training” and later replaced by  
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39 135 “job-transfer” training. “Job-transfer training” is a one-year long programme aimed at  
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41 136 the less qualified doctors currently working at CHCs or those who have not  
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43 137 undergone “on-the-job training” which entailed a series of short courses to enhance  
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45 138 their theoretical knowledge of general practice and practical clinical skills through a  
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47 139 combination of lectures, hospital rotations and community-based placements. Since  
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49 140 2011 this has been replaced by a three-year structured program with 2.5 years in  
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51 141 hospital rotations followed by six months in the community.  
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4 143 Continuous medical education (CME) aimed at maintaining, developing and  
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6 144 enhancing medical providers' professional knowledge, skills and interpersonal  
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8 145 capacity to keep abreast of professional lives, is an essential element to maintain  
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10 146 quality of care in this new system<sup>15,16</sup> and CME is compulsory for ongoing  
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12 147 registration in China. These CHC staff are required to participate in CME organised  
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14 148 by training institutions at national, provincial, municipal, district and center level, and  
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16 149 they have to fulfil at least 25 credits of approved CME every year which is accredited  
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18 150 every two years. According to the "Twelfth 5-year plan",<sup>17</sup> 100% of senior, 95% of  
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20 151 mid-grade; and 80% of junior health professionals at provincial and city levels should  
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22 152 achieve the required CME targets over two years. For staff working in western and  
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24 153 peripheral regions of China, these targets were reduced to 95%, 80% and 70%  
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26 154 respectively to reflect the phased development of primary care in these large and  
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28 155 dispersed regions of the country. The hierarchy of the titles can only be achieved after  
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30 156 passing the qualifying examination and fulfilling a number of stringent criteria  
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32 157 including CME requirements, written examinations and publication of research  
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34 158 manuscripts. This study aimed to evaluate the current organization and manpower of  
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36 159 CHCs in China, as well as the training (especially the content and delivery of CME)  
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38 160 of health professionals within primary care in China.

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## 41 162 **Methods**

42 163 A nationwide survey using a stratified randomized sample was conducted amongst  
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44 164 CHC medical professionals between September and December 2015. China was  
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46 165 divided into three administrative regions: central, eastern and western. These regional  
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48 166 differentiation are based on geographic, economical and medical jurisdiction. Two  
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50 167 provinces were randomly selected from each region; and from these, the capital city  
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52 168 and two district-level cities were selected at random. In addition, two of the four  
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54 169 major municipalities (Beijing, Shanghai, Chongqing and Tianjin) were also selected at  
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56 170 random and included in the sample. In total, twenty cities were chosen from the  
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58 171 provinces and municipalities combined. From these, nine CHCs were randomly

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3 172 selected from each city (with an urban-to-suburban ratio of 2:1), giving a total of 180  
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5 173 CHCs. The lead clinicians and all doctors and nurses (excluding traditional Chinese  
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7 174 herbalists) with direct patient contact from these selected CHCs were invited to  
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9 175 participate in the survey.

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14 177 The local chairpersons of the General Practitioner Associations of the six selected  
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16 178 provinces and two selected municipalities were contacted, whom in turn, contacted  
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18 179 the randomly selected CHCs. Training on how to distribute and complete the survey  
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20 180 questionnaire was arranged for the coordinators of each province or municipality prior  
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22 181 to the study. These coordinators were responsible for tracking and collecting the  
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24 182 questionnaires. Collected data was entered and cleaned using EPIDATA 3.1. A data  
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26 183 entry team was responsible for data input and appointed personnel for auditing and  
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28 184 quality control.

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31 186 The study consisted of two questionnaires, one for the lead clinicians and another for  
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33 187 CHC staff (i.e. doctors and nurses). The former (Appendix 1) covered current clinical  
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35 188 set-up, range of services and staff composition, community characteristics and patient  
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37 189 demographics; as well as information on CME organized at the clinic. In this survey  
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39 190 we asked the lead clinician to use their own records to estimate the median population  
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41 191 size of the catchment area and number of patient contacts in the past year. In the  
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43 192 second survey, we asked the frontline health professionals about their training  
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45 193 experience, CME participation and their willingness to conduct certain testing  
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47 194 services. CME organized by CHCs was compared with actual participation reported  
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49 195 by the CHC staff. These surveys were pilot-tested twice on three CHCs and twenty-  
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51 196 five practitioners with modifications made accordingly. Detailed methodology and,  
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53 197 availability and use of primary care facilities is reported elsewhere.<sup>18</sup>

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4 199 Descriptive analyses were conducted for percentages and frequencies of key  
5 200 parameters. These were compared with the National Health Statistics Yearbook<sup>12</sup>.  
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7 201 Confidence intervals for the sample proportions were calculated using the Agresti-  
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9 202 Coull (adjusted Wald) method. CME content were defined as ‘clinical guidelines  
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11 203 discussion’ (i.e. discussion of new clinical guidelines i.e. procedures in diagnosis or  
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13 204 new drugs in managing a patient with a selected condition common to primary care),  
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15 205 ‘management updates’ (i.e. new drugs or procedures that becomes available to the  
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17 206 CHC or changes in workflow at the practice), and ‘case discussion’ (i.e. presentation  
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19 207 of a difficult case for group input with supporting evidence form the literature). CME  
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21 208 participation and content were broken down according to the three administrative  
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23 209 districts which have different requirements for CME participation. Univariate logistic  
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25 210 regression was used to explore the staff characteristics as the independent factors  
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27 211 (with crude odds ratios (OR) and 95% confidence intervals (CI) calculated) associated  
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29 212 with participation of CME by the health professionals after adjusting for gender,  
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31 213 medical specialty, years working in the CHC, job title and education level. We also  
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33 214 examined factors related to the clinical set up, range of services offered, staff  
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35 215 composition, community characteristics and patient demographics (see Appendix 1  
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37 216 for full list of variables from questionnaire) and present in the paper factors which  
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39 217 were statistically significant. All variables with p values <0.10 was included in the  
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41 218 multivariate model and through backward elimination, we report the final variables  
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43 219 (with adjusted odds ratios (AOR)) with a p-value less than 0.05 as statistically  
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45 220 significant by convention. We adjusted the final model for age, gender, medical  
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47 221 specialty, years working in the CHC, job title and education level. Data were  
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49 222 analyzed using STATA (StataCorp. 2013. *Stata Statistical Software: Release 13*.  
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51 223 College Station, TX: StataCorp LP).

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## 54 **Results**

55 226 One hundred and forty-nine out of the 189 CHCs contacted provided data on their  
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57 227 CHC (79% response rate). Figure 1 shows the distribution of CHCs surveyed in China.



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3 228 The median number of fulltime general practitioners working at CHC was 8  
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5 229 (interquartile range (IQR) 4-14) and fulltime nurses was 13 (IQR 8-12). Of the 4,146  
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7 230 health professionals invited, 1,734 doctors and 1,846 nurses completed the survey  
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9 231 giving a response rate of 86%. A very small percentage of them might have double  
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11 232 qualifications in medicine and nursing.

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16 234 The median population size of the catchment area of each CHC was 50,000 people  
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18 235 (IQR 30,000 to 96,000) with a migrant population of 11,100 (IQR 5,000-30,000). The  
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20 236 median patient contacts per year was 41,100 (IQR 12,000 to 163,600). Table 1  
21  
22 237 provides the demographics of CHC staff compared with the 2015 National Health  
23  
24 238 Statistics Yearbook.<sup>12</sup> The median age of CHC doctors and nurses were young at 38  
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26 239 and 31 years of age, respectively, with a nurse-to-doctor ratio of 1.6. Women  
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28 240 accounted for 61% of the doctors and nearly all the nurses. About half (54.5%) of the  
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30 241 doctors had bachelor degrees or above, yet only 10.5% of them had acquired senior  
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32 242 titles. Despite the fact that all were practising as general practitioners (GPs), only 47%  
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34 243 were actually registered as one. Doctors and nurses had worked for a median of 14  
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36 244 years and 9 years, respectively.

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40 246 Table 2 shows the range and frequency of reported on-site CME and CME  
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42 247 participation at each CHC. CME activities were held by nearly all CHCs (97.2%),  
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44 248 where about two-thirds (67.1%) conducted CME sessions monthly or more frequently.  
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46 249 The type of in-house CME activities reported were clinical guidelines discussion  
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48 250 (100%), management updates (87.9%) and case discussions (83.6%).

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52 252 Table 3 shows CME participation for different types of health professionals in the  
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54 253 three administrative districts. Despite CME participation being extremely high  
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56 254 (ranging between 86% to 100% ), those in the central and eastern regions fell short of



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3 255 the targets set by the State. In contrast to what was expected by the government, there  
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5 256 was no significant difference of CME participation by GPs in the three administrative  
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7 257 regions and CME participation was actually commoner among junior doctors in the  
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9 258 western and peripheral regions compared to the central and eastern regions (p=0.036).

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13  
14 260 Table 4 summarizes the multivariate analysis of health professionals' characteristics  
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16 261 with CME participation. Amongst doctors, CME participation was commoner among  
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18 262 older doctors (adjusted odds ratios (aOR) 1.04 per year), women (aOR 1.7), those  
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20 263 registered as GPs (aOR 3.0) and those with an intermediate or senior job title (aOR  
21  
22 264 2.2). Amongst nurses, CME participation was commoner among those with bachelor  
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24 265 degrees (aOR 2.9), with longer experience working in general practice (aOR 1.1 per  
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26 266 year) or with an intermediate or senior job title (aOR 2.2).

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## 29 30 268 **Discussion**

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32 269 This large study of China's CHCs examines the current primary care workforce and  
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34 270 finds it is predominantly staffed by young female health professionals, with only half  
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36 271 of doctors holding a bachelor degree or higher, or registered as a GP. The relatively  
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38 272 low nurse-to-doctor ratio may reflect the focus of care on doctor-centred approach in  
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40 273 the traditional medical model. Indeed the lead physicians reported on average there  
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42 274 were 1-2 pharmacists, physiotherapists, laboratory technicians or radiographers but  
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44 275 clinical psychologists or medical social workers were uncommon. The ratio was far  
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46 276 from the international standard of approximately three nurses per doctors as  
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48 277 recommended by World Health Organization (WHO).<sup>19</sup> Evidence exists that an  
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50 278 undersupply of nurses could result in inefficient allocation of resources.<sup>20</sup>

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54 280 For historical reasons, many practicing health professionals at CHCs do not have a  
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56 281 bachelor degree.<sup>14</sup> Indeed, our study shows just over half of the doctors and under a

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3 282 third of the nurses working in primary care have a bachelor degree. This may  
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5 283 contribute in part to the perception of poor training and poor quality in primary care.  
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7 284 The quality of health care should be based upon the quality of the workforce rather  
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9 285 than just increasing the sheer quantity of staff as it has been the focus of China's  
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11 286 policy on development of primary care thus far. The education level and title seniority  
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13 287 through examination are considered important indicators of professional standards and  
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15 288 competency. Nurses who have a higher level of education provide better health care  
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17 289 and safety for their patients.<sup>21</sup>  
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291 In China, due to the short history of primary care development, many senior doctors  
292 were previously either public health physicians or specialist who converted to being  
293 GPs and were given the task of setting up CHCs. Previously “on-the-job” and now  
294 “job-transfer” training is offered to the specialists who have converted to work as GPs  
295 before sitting the qualifying examination. In order to attract them to primary care,  
296 they are allowed to keep up to three specialties on their registration but in our survey,  
297 only 47% of the doctors chose to register general practice as their prime registration.  
298 We confirm that the CME participation rates for those registered as GPs are higher  
299 than those still registered as a specialist. Further, 97% of staff members with  
300 intermediate and senior level job titles participated in CME, which accounted for 39%  
301 of all CHC health professionals (52% of GPs and 29% of nurses). An advancement in  
302 job titles may provide a sense of ownership and autonomy,<sup>9</sup> and thus was identified as  
303 an independent factor in the participation of CME in our study.  
304

305 CME is a requirement for practicing professionals in many countries including China  
306 in order to maintain medical knowledge and skills.<sup>22</sup> Doctors who do not participate in  
307 CME have lower confidence when making clinical decisions.<sup>21</sup> Although it is  
308 encouraging to see nearly all CHC staff had participated in CME, one-third of CHCs

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3 309 organize on-site CME activities once every quarter or even once a year, which is far  
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5 310 from satisfactory. A Cochrane review suggests that CME should be accessible within  
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7 311 health professionals' own clinical communities.<sup>23</sup> Other forms of CME might include  
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9 312 attending professional conferences, research workshops or distance learning courses  
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11 313 so long as they have been approved by the postgraduate center in their respective city  
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13 314 but the focus of CME undergone by doctors or nurses could be different and there are  
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15 315 no fixed rules as how frequent they should attend these activities. Learning objectives  
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17 316 must be tailored beyond meeting the staff's CME requirements where each CHC or  
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19 317 jointly in a locality should take into account the local context and needs e.g. the local  
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21 318 disease pattern and epidemiology, and to provide the necessary training and support to  
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23 319 their staff to address the skill-mix to deliver the service.

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26 321 Arguably, reflective learning, meeting self-defined learning objectives and auditing  
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28 322 clinical performance with practitioners expected to demonstrate certain competencies  
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30 323 in managing the patients independently, would be more appropriate in quality  
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32 324 improvement rather than time-based training.<sup>21</sup> Lack of time and appropriate  
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34 325 resources have been reported as obstacles for CME participation in China.<sup>24</sup>  
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36 326 Alternatives such as self-directed searches in the medical literature or medical  
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38 327 websites, or structured resources on the internet (e.g. BMJ learning) or medical  
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40 328 journals, exist to meet their learning needs.<sup>25,26</sup> Nonetheless these alternatives are  
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42 329 limited by the motivation and skills required to perform these searches effectively as  
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44 330 well as the availability and accessibility (including the language barrier) of these  
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46 331 resources.

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49 333 Our study suggests that 97.2% of CHCs hold discussions and learning sessions about  
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51 334 treatment protocols and 84.8% on disease updates. If used well, evidence-based  
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53 335 medicine can aid health professionals in making the most appropriate therapeutic  
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55 336 decisions for individual patients and conditions at the clinical level. However, rapid  
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57 337 advancements in therapeutic methods and multiple guidelines from both local and

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3 338 international agencies have made it difficult for health professionals to follow them  
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5 339 closely. Primary healthcare staff can learn and incorporate these new updates and  
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7 340 guidelines into their clinical practices only when they engage in the dissemination and  
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9 341 implementation at the early stage, and have the support of their senior colleagues.  
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11 342 Moreover, GPs need to take the opportunities provided by CME to share difficulties  
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13 343 when dealing with individual patients and build the team to cope with different  
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15 344 professional environments.<sup>27</sup> Significant event audit is a regular and compulsory part  
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17 345 of annual appraisal for all doctors in the NHS in the UK.<sup>28</sup>

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21 347 Our survey found that the current CME participation fell short of the overall 95%  
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23 348 standard from the “Twelfth Five Years Plan”,<sup>17</sup> where 92% of doctors and 89% of  
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25 349 nurses surveyed reported regular CME participation. Contrary to what was believed  
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27 350 by the policymakers (as reflected in the targets set), participation rates for doctors  
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29 351 from the Western and peripheral region CME not only exceeded the target, but  
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31 352 evidently Western and peripheral region doctors of junior title had participated more  
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33 353 than their counterparts in the other regions, which suggests such regional  
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35 354 differentiation is unnecessary.

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39 356 This study should be interpreted in light of some limitations. The main limitation of  
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41 357 this study was that we only focused on CME activities that were organised by CHCs  
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43 358 but arguably those were the most commonly attended by the staff of individual CHCs.  
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45 359 It would be valuable to also know how frequently staff participated in CMEs  
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47 360 conducted outside of organizations (e.g. by training institutions or self-directed  
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49 361 learning). We did not evaluate the quality of CME being delivered nor whether  
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51 362 observable health improvements had resulted from CME participation. Other  
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53 363 important parameters for CME evaluation to consider would be costs to attend CME,  
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55 364 management support, funding/resources, quality of CME instructors/coaches.

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3 365 Although we surveyed over 3,500 medial staff from a random sample of CHCs in  
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5 366 China, they may not be representative of all CHC staff in China. Moreover, social  
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7 367 desirability may be a source of bias especially if participation in the survey was  
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9 368 encouraged by the supervisors. These could be the subject of future research through  
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11 369 in-depth qualitative interviews of CHC staff and focused evaluations of CME  
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13 370 programs in China.

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## 17 372 **Conclusion**

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20 373 In this study, it shows the high participation rates of CME amongst health  
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22 374 professionals in CHCs, if used well, could maintain high standards of practice  
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24 375 amongst the primary care workforce in China. CHCs could focus on improving  
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26 376 nurses-to-doctor, bachelors-to-non-graduate and title seniority ratios as quality  
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28 377 workforce improvements. There are disadvantages to continue to rely on conversion  
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30 378 of specialists as a source of primary care workforce. At the same time, CME  
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32 379 programmes should be decentralised and take on various forms to meet the local and  
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34 380 individual needs whilst regional CME differentiation is unnecessary.

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## 37 382 **Conflict of Interest**

38 383 The authors declare that they have no competing interests to declare.

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## 43 385 **Ethical Considerations**

44  
45 386 Ethics Committee approvals from a local board (HKU/HAW IRB: UW15-350) and  
46  
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48  
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#### 43 44 411 **Contributorship Statement**

45  
46 412 William CW Wong designed the study and the questionnaire, and wrote up the report.  
47  
48 413 ShanZhu Zhu led the team and oversaw the implementation, and liaised with different  
49  
50 414 Chinese GP Associations. Jason Ong conducted the data analysis, and drafted the  
51  
52 415 results of the manuscript with William CW Wong. MingHui Peng implemented the  
53  
54 416 study and helped some of the data analysis. Cindy L. K. Lam, Michael R Kidd and  
55  
56 417 Martin Roland advised on the study design and questionnaire, and commented on the

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3 418 reports. SunFang Jiang led the team and oversaw the implementation, led the pilot  
4  
5 419 testing as well as implementation of the study, took part in the discussion and  
6  
7 420 modification of the design and the questionnaire.  
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12 422 **Reference**

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488 [research/our-programmes/quality-improvement/significant-event-audit.aspx](http://www.rcgp.org.uk/clinical-and-research/our-programmes/quality-improvement/significant-event-audit.aspx)

For peer review only

489 **Table 1.** Basic characteristics and training of CHC health professionals,  
 490 compared with the 2015 National Health Statistics Yearbook<sup>12</sup>

Variables	DOCTORS		2015 Yearbook	NURSES		2015 Yearbook
	n/N	% (95% CI)		n/N	% (95% CI)	
Median Age (IQR)		38 (32-46)	-		31 (26-39)	-
<b>Gender</b>						
Female	1,025/ 1675	61.2 (58.8-63.5)	53.2	1,793/ 1803	99.4 (99.0-99.7)	99.4
<b>Education</b>						
Below associate degree	202/ 1724	11.7 (10.2-13.3)	19.1	382/ 1831	20.9 (19.0-22.8)	44.4
Associate degree*	582/ 1724	33.8 (31.5-36.0)	36.9	920/ 1831	50.2 (47.9-52.6)	48.3
Bachelor degree or higher	940/ 1724	54.5 (52.1-56.9)	44.0	529/ 1831	28.9 (26.8-31.0)	10.3
<b>Job title</b>						
Senior	180/ 1711	10.5 (9.1-12.1)	10.5	46/ 1815	2.5 (1.9-3.4)	1.5
Intermediate	705/ 1711	41.2 (38.9-43.6)	41.3	471/ 1815	26.0 (23.9-28.0)	22.2
Junior	683/ 1711	39.9 (37.6-42.3)	41.9	1,158/ 1815	63.8 (61.5-66.0)	66.9
None	143/ 1711	8.4 (7.1-9.8)	6.2	140/ 1815	7.7 (6.5-9.0)	9.4
<b>Registered Speciality</b>						
Integrative Medicine	145/ 1700	8.5 (7.2-10.0)	-	2/ 1834	0.1 (0.0-0.4)	-
General practice	799/ 1700	47.0 (44.6-49.4)	-	85/ 1834	4.6 (3.7-5.7)	-
Other Specialty	454/ 1700	26.7 (24.6-28.9)	-	19/ 1834	1.0 (0.6-1.6)	-
Nurse	23/ 1700	1.4 (0.9-2.0)	-	1712/ 1834	93.3 (92.1-94.4)	-
None	75/ 1700	4.4 (3.5-5.5)	-	30/ 1834	1.6 (1.1-2.3)	-
Other	295/ 1700	17.4 (15.6-19.2)	-	18/ 1834	1.0 (0.6-1.5)	-
<b>Median Years working in above speciality (IQR)</b>	14 (7-23)		-	9 (4-18)		-

491 \* Associate degree refers to 2-years health related sub-degree equivalent to a physician assistant

492 CI=Confidence interval, IQR = interquartile range

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494 **Table 2.** Continuous medical education organised and undertaken by the CHCs.

	n/N	% (95%CI)
CHC offering Continuous Medical Education	140/144	97.2 (93.0-99.2)
<b>Frequency of CME organised at CHCs</b>		
Yearly	16/140	11.4 (7.1-17.9)
Quarterly	25/140	17.9 (12.3-25.1)
Bimonthly	13/140	9.3 (5.4-15.4)
Monthly	77/140	55.0 (46.7-63.0)
Biweekly	15/140	10.7 (6.5-17.0)
Weekly	2/140	1.4 (0.1-5.4)
<b>Staff participating in CME</b>		
Managers	140/140	100 (96.8-100)
Doctors	140/140	100.0 (96.8-100.0)
Nurses	140/140	100.0 (96.8-100.0)
Other medical staff	126/140	90.0 (83.8-94.1)
<b>Types of CME activities</b>		
Clinical guideline discussion	140/140	100 (96.8-100)
Management updates	123/140	87.9 (81.3-92.4)
Case discussions	117/140	83.6 (76.5-88.9)

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499 **Table 3.** CME participation for different types of health professionals according to  
 500 the three administrative districts (as reported by CHC staff, n=3,580)

	CENTRAL		WESTERN & PERIPHERAL		EASTERN		$\chi^2$	<i>p</i> -value
	n/N	% (95% CI)	n/N	% (95% CI)	n/N	% (95% CI)		
<b>Health professionals</b>	701/786	89.2 (86.8-91.3)	916/1018	90.0 (88.0-91.8)	1519/1655	91.8 (90.4-93.1)	5.04	0.08
Doctors	370/407	90.9 (87.7-93.5)	424/462	91.8 (88.9-94.1)	751/807	93.1 (91.1-94.7)	1.89	0.39
Nurse	331/379	87.3 (83.6-90.5)	492/556	88.5 (85.5-91.0)	768/848	90.6 (88.4-92.4)	3.31	0.19
<b>Job titles</b>								
Intermediate & Senior	270/282	95.7 (92.7-97.8)	280/290	96.9 (93.8-98.3)	764/786	97.2 (95.8-98.2)	1.46	0.48
Junior	399/456	87.5 (84.1-90.4)	525/569	92.3 (89.8-94.3)	681/763	89.3 (86.8-91.4)	6.64	0.036
<b>Education level</b>								
Bachelor & higher	380/442	86.0 (82.4-89.1)	646/731	88.4 (85.8-90.6)	739/829	89.1 (86.8-91.2)	2.83	0.24
Associate degree and below	316/339	93.2 (90.0-95.7)	265/282	94.0 (90.5-96.4)	770/814	94.6 (92.8-96.0)	0.85	0.66
<b>Registered specialty</b>								
GPs	146/151	96.7 (92.3-98.9)	143/143	100 (97.5-100)	464/487	95.0 (93.0-97.0)	5.73	0.057
Specialists	217/246	88.2 (83.5-92.0)	272/308	88.3 (84.2-91.7)	281/316	88.9 (84.9-91.2)	0.087	0.96

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513 **Table 4** Crude and adjusted odds ratios for participation in CME by health  
 514 professionals

Participation in CME for doctors (n=1587)	Crude OR (95% CI)	p value	Adjusted OR* (95% CI)	p value
Age	1.08 (1.06-1.11)	<0.01	1.04 (1.02-1.07)	<0.01
Female	1.86 (1.24-2.79)	<0.01	1.72 (1.12-2.63)	0.01
Graduate degree or above	1.45 (1.02-2.08)	0.04	-	-
GP specialty	4.24 (2.69-6.67)	<0.01	2.97 (1.83-4.81)	<0.01
Years working in occupation	1.07 (1.04-1.09)	<0.01	-	-
Senior or intermediate job title (junior title as reference)	4.22 (2.74-6.48)	<0.01	2.16 (1.31-3.56)	<0.01
Participation in CME for nurses (n=1683)				
Age	1.09 (1.06-1.11)	<0.01	-	
Graduate degree or above	3.29 (2.10-5.16)	<0.01	2.85 (1.79-4.55)	<0.01
Years working in occupation	1.10 (1.07-1.13)	<0.01	1.08 (1.05-1.11)	<0.01
Senior or intermediate job title (junior title as reference)	1.59 (1.06-2.11)	<0.01	2.16 (1.17-4.00)	0.01

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517 \* Adjusted for age, gender, medical specialty, years working in the CHC, job title and education level

518 CI = confidence interval, OR = odds ratio

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528 **Figure 1** Geographical distribution of the selected cities participated in the survey

For peer review only

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Geographical distribution of the selected cities participated in the survey

120x90mm (220 x 220 DPI)

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## Appendix 1

The factors considered for an association with CME participation were:

- Age (continuous variable)
- Gender (Male, Female)
- Ethnicity (Han, Minority, Other)
- Highest Qualification (Lower than associate degree, associate degree, graduate degree with postgraduate qualifications)
- Registered specialty (Integrative medicine, General practice, Other specialty, Nurse, None)
- Current field of work (Integrative Medicine, General, Other specialty, Nurse, None)
- Years of practice in current field of work (continuous variable)
- Title of technical post (Senior, Intermediate, Junior, None)
- Hours spent on patient care (continuous variable)
- Patients in CHC in the last month (Intravenous drug user, female sex worker, male sex worker, men who have sex with men, transgender people)
- Training in HIV prevention, counselling, diagnosis and care (yes/no)
- Training in common STI prevention counselling, diagnosis and care (yes/no)
- Attitudes towards HIV/STI testing in key populations (strongly disagree/disagree, neither agree or disagree/agree/strongly agree/don't know)
  - I think routine STI testing is an important part of regular healthcare
  - I am concerned about cost and reimbursement for STI testing
  - I am concerned that patients will be offended by being offered routine STI testing
  - I am comfortable discussing routine STI testing with patients
  - Language barriers prevent some patients from receiving routine STI testing
  - Patients often feel like they have to accept routine STI testing
  - Patients receive adequate post-test information for routine STI testing
  - Routine STI testing is voluntary; patients are able to decline screening
  - Patients do not expect to be offered routine STI testing
  - I am concerned that routine STI testing will have a negative effect on patients' opinions about our clinic
  - We have the resources needed to implement STI testing
  - It is difficult to provide the privacy needed for routine STI testing
  - I think routine HIV testing is an important part of regular healthcare
  - I am concerned about cost and reimbursement for HIV testing
  - I am concerned that patients will be offended by being offered routine HIV testing
  - I am comfortable discussing routine HIV testing with patients
  - Language barriers prevent some patients from receiving routine HIV testing
  - Patients often feel like they have to accept routine HIV testing
  - Patients receive adequate pre-test information for routine HIV testing
  - Patients receive adequate post-test information for routine HIV testing
  - Routine HIV testing is voluntary; patients are able to decline screening
  - Patients do not expect to be offered routine HIV testing
  - I am concerned that routine HIV testing will have a negative effect on patients' opinions about our clinic

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- We have the resources needed to implement HIV testing
- It is difficult to provide the privacy needed for routine HIV testing
- I can ask the sexual orientation of the patients
- I can obtain a sexual and reproductive health history from the patients

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STROBE Statement—Checklist of items that should be included in reports of *cross-sectional studies*

	Page No	Recommendation
<b>Title and abstract</b>	1	(a) Indicate the study's design with a commonly used term in the title or the abstract
	2	(b) Provide in the abstract an informative and balanced summary of what was done and what was found
<b>Introduction</b>		
Background/rationale	4	Explain the scientific background and rationale for the investigation being reported
Objectives	6	State specific objectives, including any prespecified hypotheses
<b>Methods</b>		
Study design	7	Present key elements of study design early in the paper
Setting	7	Describe the setting, locations, and relevant dates, including periods of recruitment, exposure, follow-up, and data collection
Participants	7-8	(a) Give the eligibility criteria, and the sources and methods of selection of participants
Variables	7-8	Clearly define all outcomes, exposures, predictors, potential confounders, and effect modifiers. Give diagnostic criteria, if applicable
Data sources/ measurement	7-8	For each variable of interest, give sources of data and details of methods of assessment (measurement). Describe comparability of assessment methods if there is more than one group
Bias	7-9	Describe any efforts to address potential sources of bias
Study size	7	Explain how the study size was arrived at
Quantitative variables	7-8	Explain how quantitative variables were handled in the analyses. If applicable, describe which groupings were chosen and why
Statistical methods	8	(a) Describe all statistical methods, including those used to control for confounding (b) Describe any methods used to examine subgroups and interactions (c) Explain how missing data were addressed (d) If applicable, describe analytical methods taking account of sampling strategy (e) Describe any sensitivity analyses
<b>Results</b>		
Participants	9	(a) Report numbers of individuals at each stage of study—eg numbers potentially eligible, examined for eligibility, confirmed eligible, included in the study, completing follow-up, and analysed (b) Give reasons for non-participation at each stage (c) Consider use of a flow diagram
Descriptive data	9	(a) Give characteristics of study participants (eg demographic, clinical, social) and information on exposures and potential confounders (b) Indicate number of participants with missing data for each variable of interest
Outcome data	9-10	Report numbers of outcome events or summary measures
Main results	10	(a) Give unadjusted estimates and, if applicable, confounder-adjusted estimates and their precision (eg, 95% confidence interval). Make clear which confounders were adjusted for and why they were included (b) Report category boundaries when continuous variables were categorized (c) If relevant, consider translating estimates of relative risk into absolute risk for a meaningful time period
Other analyses	10	Report other analyses done—eg analyses of subgroups and interactions, and sensitivity analyses

<b>Discussion</b>		
Key results	10-13	Summarise key results with reference to study objectives
Limitations	14	Discuss limitations of the study, taking into account sources of potential bias or imprecision. Discuss both direction and magnitude of any potential bias
Interpretation	14	Give a cautious overall interpretation of results considering objectives, limitations, multiplicity of analyses, results from similar studies, and other relevant evidence
Generalisability	14	Discuss the generalisability (external validity) of the study results
<b>Other information</b>		
Funding	15	Give the source of funding and the role of the funders for the present study and, if applicable, for the original study on which the present article is based

\*Give information separately for exposed and unexposed groups.

**Note:** An Explanation and Elaboration article discusses each checklist item and gives methodological background and published examples of transparent reporting. The STROBE checklist is best used in conjunction with this article (freely available on the Web sites of PLoS Medicine at <http://www.plosmedicine.org/>, Annals of Internal Medicine at <http://www.annals.org/>, and Epidemiology at <http://www.epidem.com/>). Information on the STROBE Initiative is available at [www.strobe-statement.org](http://www.strobe-statement.org).